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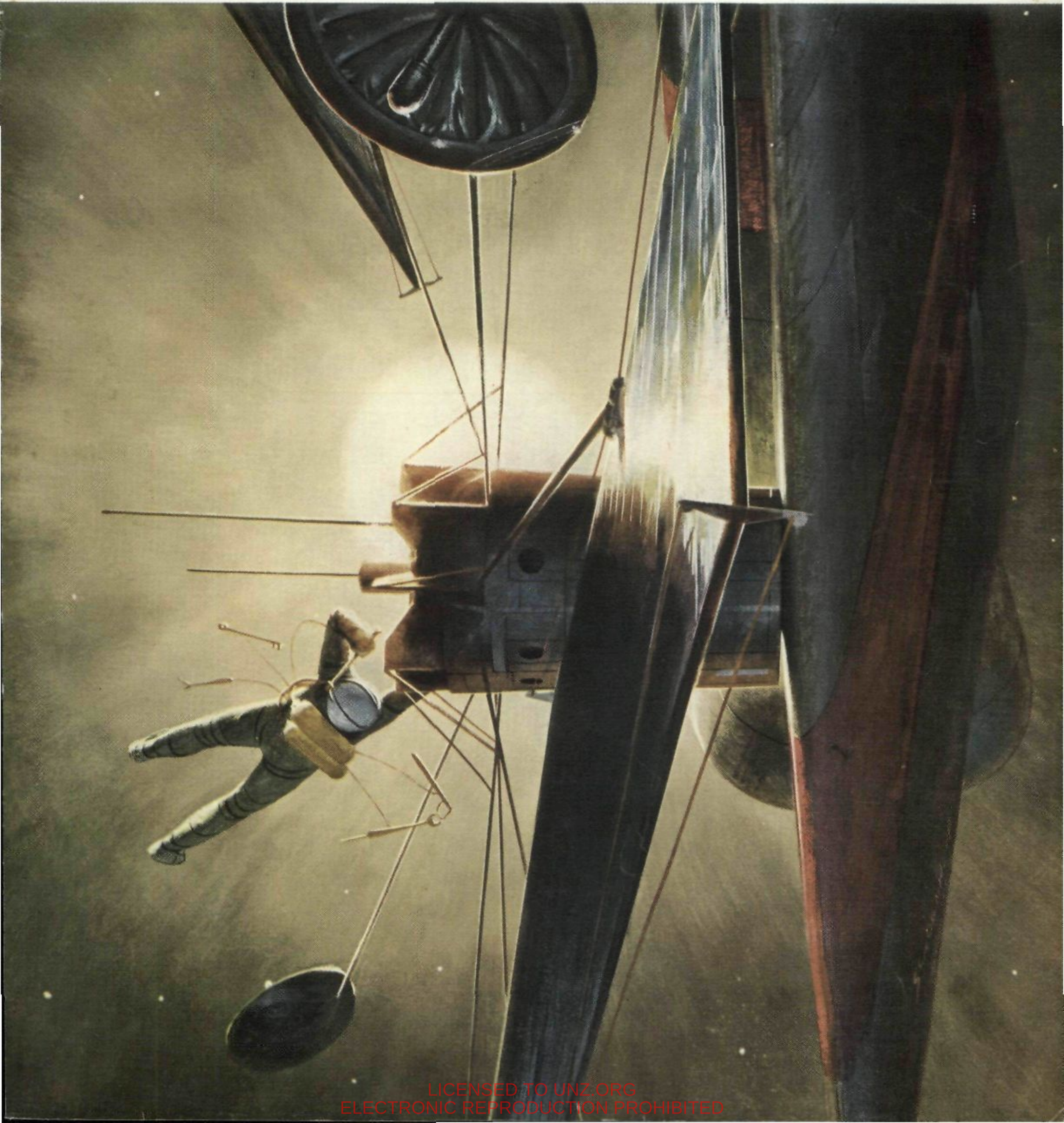

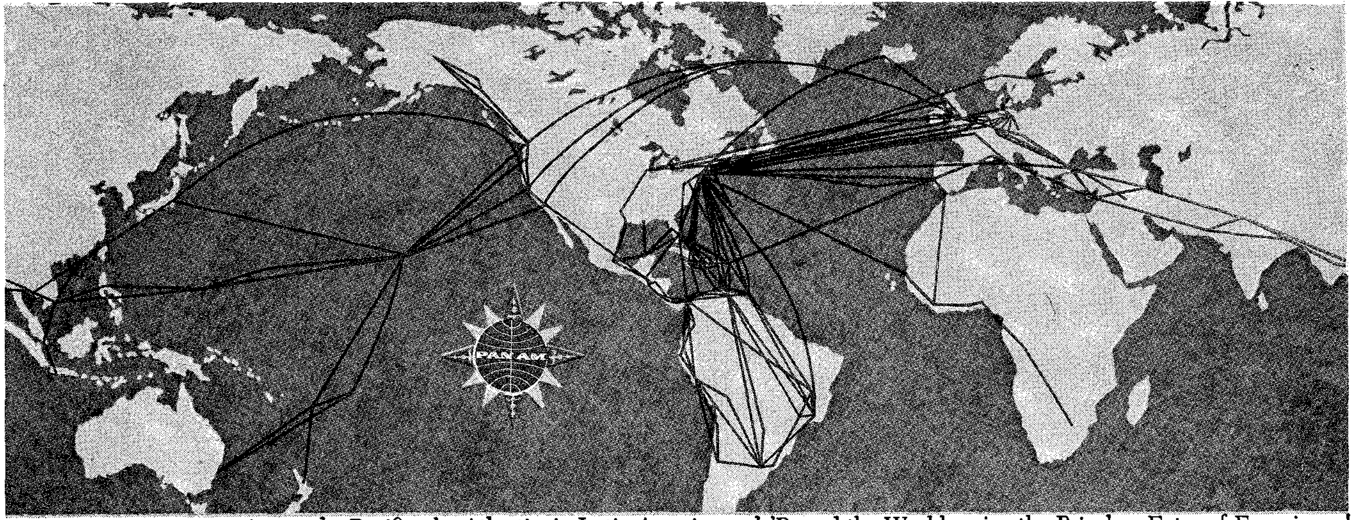

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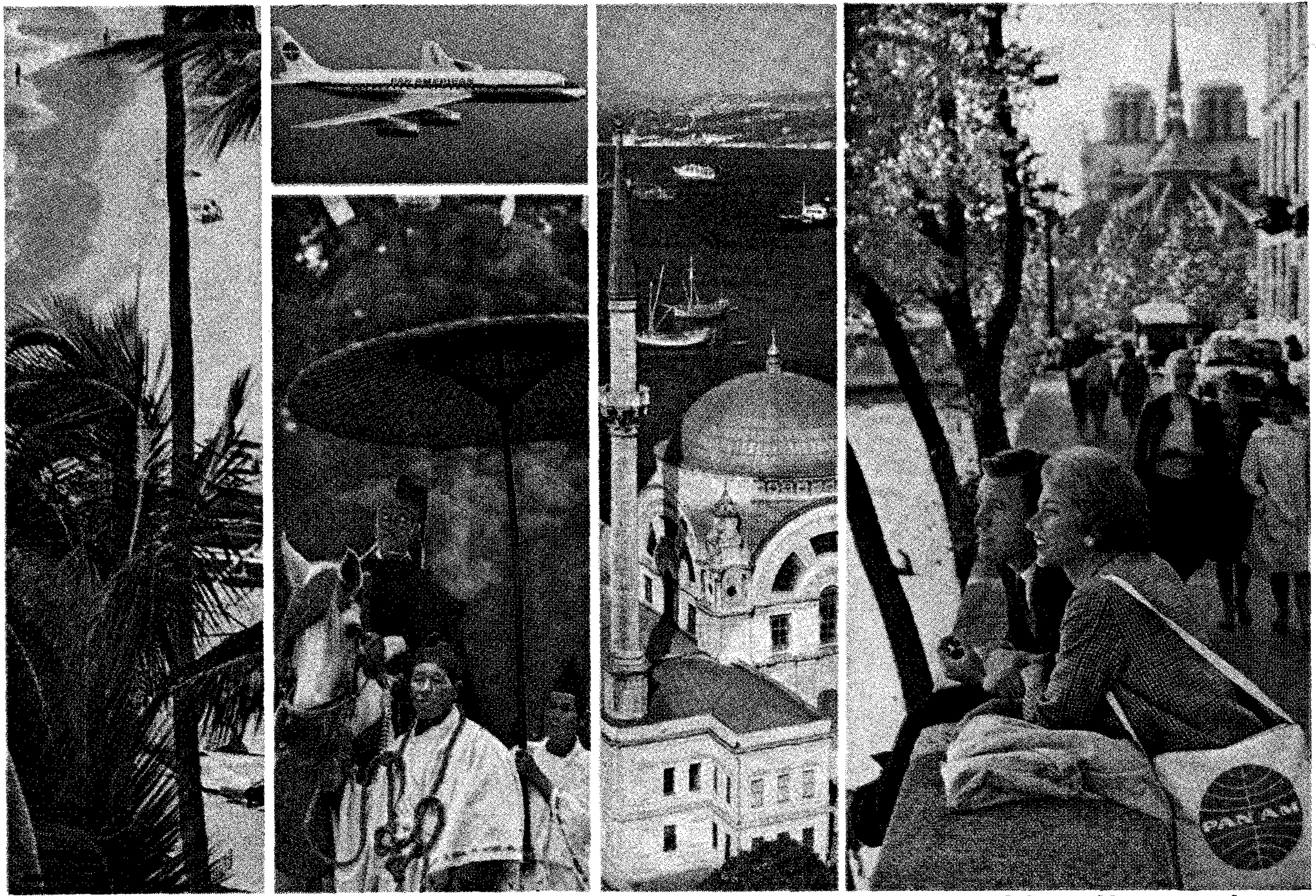

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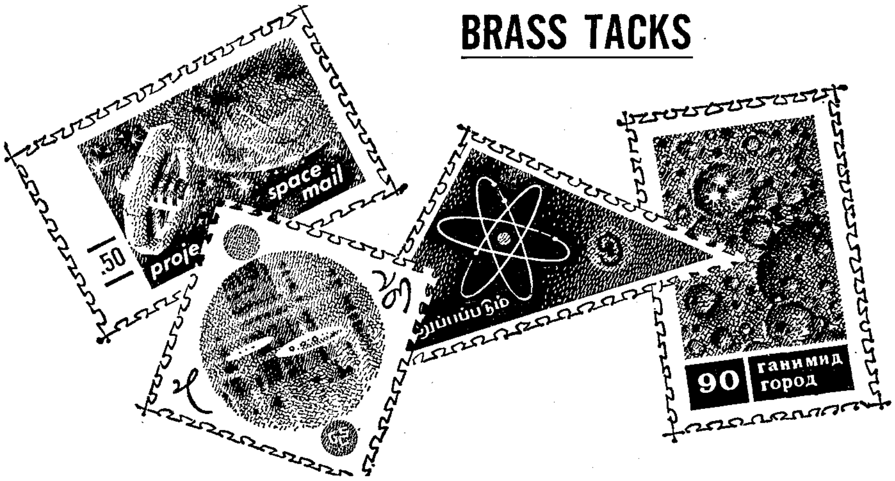


Dear Mr. Campbell:

Thanks to Frank Herbert for presenting one of the most mature and highly readable science fiction stories of the past few years.

I praise not the technical and scientific merits of Mr. Herbert's story—though there are undoubtedly many—but the literary qualities. Even a science-fiction writer must find praise for other than his technical knowledge refreshing now and then.

Most letters to your omnipotence the editor of Analog, seem usually to dwell over the pros and cons of some technical or scientific bric brac, or point in the story. Not that this is wrong. Quite the reverse as your letter column would otherwise turn into the "how wonderful we all are" stagnation so prevalent in many publications.

But praise where praise is due, and my praise is for the literary qualities of Mr. Herbert's story "Dune World"—though I'm also thankful for the intricate construction of social systems he portrays so vividly in the clash of cultures on the desert world Arrakis.

His story contained some of the best characterization in the genre in much too long a time. The only fault I find, is that Mr. Herbert ended his novel a little too abruptly. (Or was it the editor who didn't want to extend it another month?) Paul's realization of who or what he was and the extent of his abilities was a little too abrupt a *deux ex machina,* in wrapping up the story.

Perhaps when Mr. Herbert presents the final draft of the novel for book publication—and I have no doubt it will be published in book form—he will develop his ending more fully. Hawat, Gurney Halleck, etcetera, are much too fully developed characters for the reader not to want to know what happened to them in greater detail. I for one will be among the first to buy the full novel if this is done. Once again my thanks to Frank Herbert for one of the most enjoyable stories in a long while.

R. C. MUNN

185 Theresa Street,
Port Arthur, Ontario, Canada

The ending is being developed more fully—120,000 words full. It'll be ready late in 1964, and will appear here!

Dear John:

Although I enjoyed Mr. McLaughlin's story and solution, I believe that the effects pictured are about an order of magnitude too severe.

What is pictured is a congruency of two regions of space: our atmosphere and some low-pressure region. Flow has been established from the high-pressure system to the low-pressure system. To a good approximation the flow in both regions will be of the source or sink type. That is, in our atmosphere the flow streamlines converge as they approach the congruency and diverge after the congruency. Thus, the flow field is similar to a converging-diverging nozzle, except that in this case it's three-dimensional. The main point here is that the congruency corresponds to the "throat" of a converging-diverging nozzle. Therefore, the Mach number at the congruency is one provided the pressure on the other side is sufficiently low.

On the basis of this reasoning the pressure, temperature, et cetera, at the congruency will be the "cortical conditions" so that the pressure will be approximately 7.8 psia and the temperature approximately 20 degrees below zero—our men are wearing tee-shirts? Since the flow field in our atmosphere is, to an approximation, a sink flow; the flow area will vary as the square of the radius. My calculations indicate that at a distance of only thirty-three feet from the congruency —assuming the diameter of the congruency is ten feet—the Mach number is down to 0.01—the air speed is a mild breeze of eight miles per hour—and the pressure and temperature are essentially the normal values. Moreover, my calculations indicate that for a ten-foot diameter congruence it would take somewhere on the order of 2×10^9 hours—a reasonably long time—to reduce the atmosphere pressure by 0.1 per cent.

As a final comment let us hope that all future congruences are limited to low-pressure regions. A congruency with a stellar interior would be much more difficult to handle!

ROBERT L. GLICK
2342 Pansy Street S. W.
Huntsville, Alabama

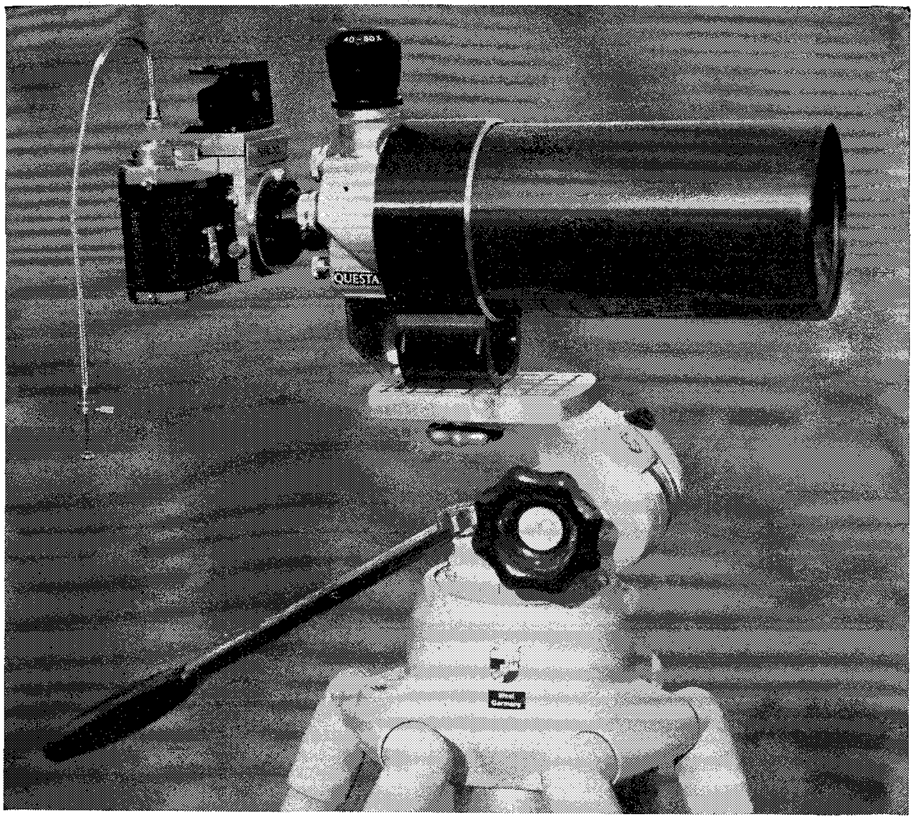
You know—that type of congruency would be rugged! Or even a congruency with the lower layers of Jupiter's ammonia-hydrogen atmosphere.

Dear Mr. Campbell:

I fear you missed your forte. Since *Mad* was not in business when you started editing, you had to settle for SF. Your mention of rifles in the Kennedy assassination editorial almost roused me to mirth.

A modern rifle *can* kill a man at a mile, if it hits him in a vital spot, and

continued on page 90



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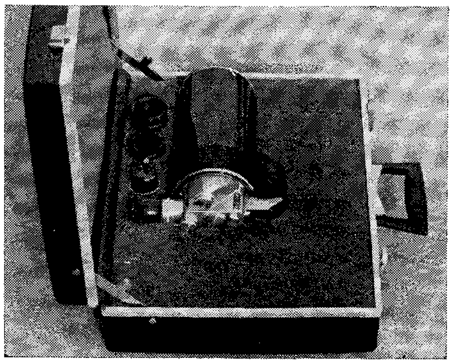

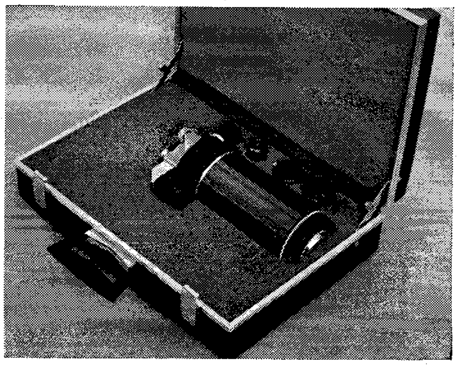

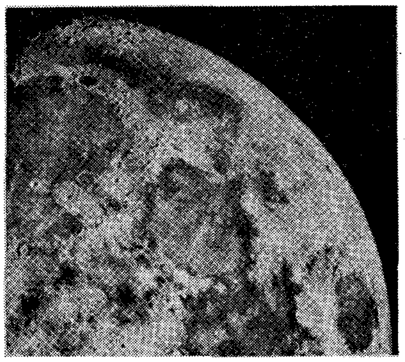

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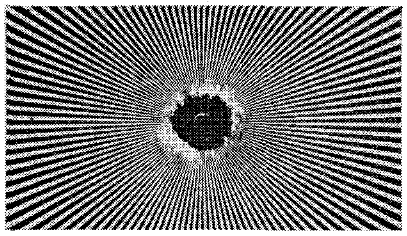

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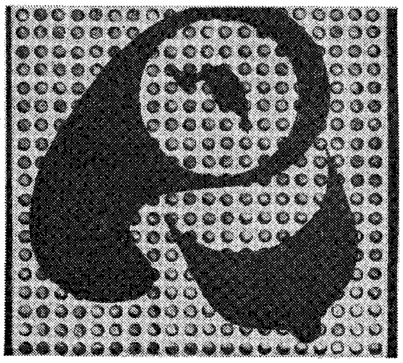

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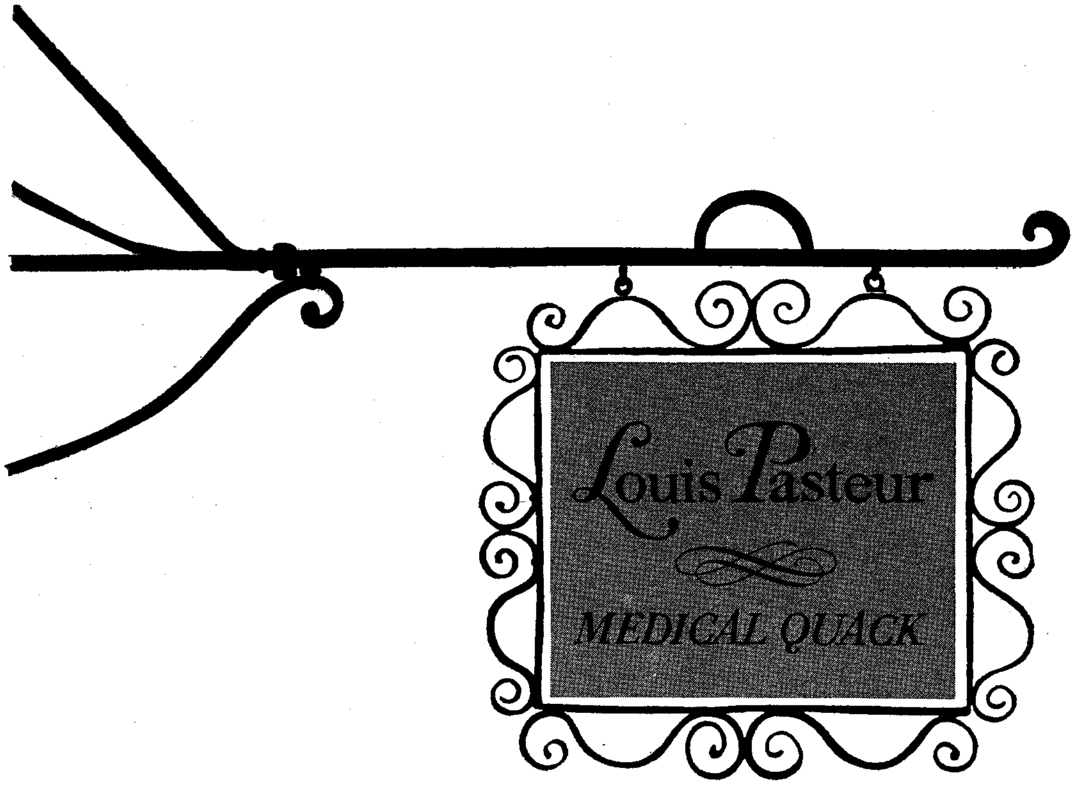

Louis Pasteur

MEDICAL QUACK

EDITORIAL BY JOHN W. CAMPBELL

"Be not the first by whom the new is tried,
"Nor yet the last to cast the old aside."

Polonius' advice to Laertes, from "Hamlet."

My recent editorial on "Fully Identified," concerning the FDA's press splash that Krebiozen had been "fully identified" as creatine brought in a lot of letters, and a lot of phone calls from people acutely interested in Krebiozen.

My point in the editorial had been single, simple, and specific: whether Krebiozen was or was not useful in treatment of cancer I did not know—but that the FDA's press release was exceedingly bad science, anyone who took the trouble to study the matter a little could readily see. It was a great piece of publicity work—all about the summer student who tracked down the spectrogram . . . charts and what-not—got a big splash in *Life* and the newspapers. As publicity stuff, that was a Grade A piece of work. Having some familiarity with the art myself, I

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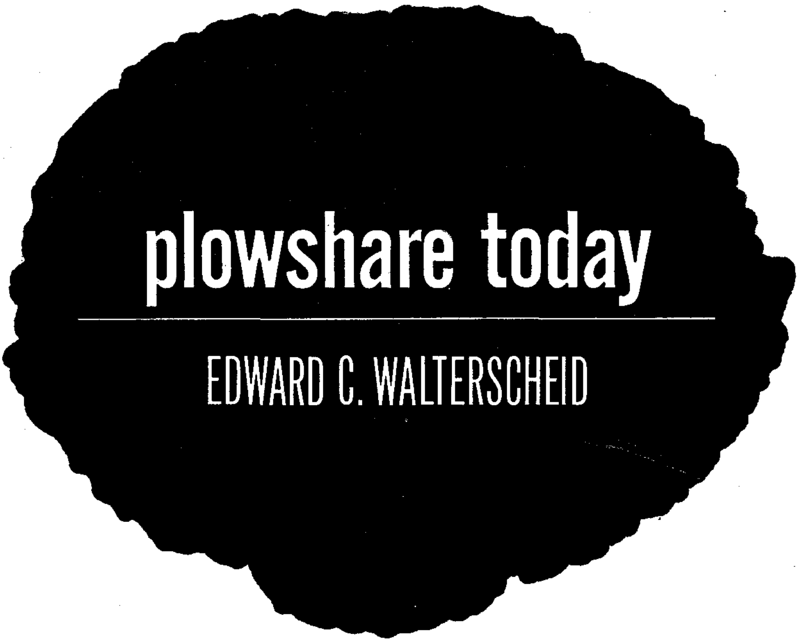
plowshare today

EDWARD C. WALTERSCHEID



The Sedan crater viewed from almost directly overhead. The smaller craters in the background are the results of earlier testing in the same area.

Anybody want any large—very large, maybe economy-size!—holes blasted somewhere? Peaceful application of nuclear explosives isn't as simple as it might be, because they come in such excessively large-size units!

■ In a recent paper based on the 1962 annual lecture of the American Nuclear Society, Dr. Edward Teller has a section which is titled simply "Dreams." The section is concerned with possible industrial applications of nuclear explosives. Mentioned are the formation of large heat reservoirs which could possibly be used in the distillation of sea water, and new methods of mining in which the heat and pressure of a nuclear explosion would change the composition of minerals to forms that could be much more easily extracted from the earth.

These possible applications of nuclear explosives come under the heading of dreams today because there is doubt concerning their economic or even their technical feasibility. There are other applications, however, which have definitely been moved from the realm of dreams to that of reality.

Almost since the beginning of the wartime Manhattan Project, scientists in this country have proposed various schemes for the constructive uses of nuclear explosives; however, it was not until 1957 that the United States Government formally began a program to study such uses. The program was called Project Plowshare—a name chosen because of its appropriately biblical connotation.

Much has been written about the dreams of Plowshare, but what are its realities?

Seven years have passed since Plowshare's inception, and several hundred nuclear detonations have occurred. Of these, only two are known specifically to have been for nonmilitary purposes. These were the underground Gnome shot at Carlsbad, New Mexico, in December 1961 and the Sedan cratering shot detonated at the Nevada Test Site in July 1962.

At the beginning of the Plowshare program it was realized that the problems connected with the constructive utilization of nuclear explosives fall into several general categories which are, however, interrelated. They are: (1) the choice of useful projects, (2) technical feasibility, and (3) economic feasibility. Today, most Plowshare scientists feel that the basic problems inherent in each of these categories have been at least partially resolved.

Although a large number of possible applications have been investigated, projects currently under active consideration are: earthmoving, power generation, isotope production, water resources development, and mining applications. Of these, the one perhaps closest to fruition is earthmoving.

When the Plowshare program began in July 1957, little or nothing was known about the constructive uses of nuclear explosives. Understandably, the military were more concerned with their destructive uses. As a consequence, although there had been eighty-five announced nuclear detonations by the United States, very little data directly applicable to Plowshare were available. Eighty-one of these shots were conducted in the atmosphere at varying heights. Of the remaining four, two were shallow underground tests (17 and 67 feet below the surface) and two were underwater, one shallow (90 feet under) and one deep (2,000 feet below sea level).

These shots did, however, have an effect on the future course of the Plowshare program. They showed that there were three very definite problems associated with atmospheric or shallow underground or underwater shots. These problems were bright flash, blast, and fallout. The primary problem from the public viewpoint in 1957—as today—was considered to be fallout. Plowshare scientists considered blast to be the greater problem.

The most obvious solution to all three problems—in varying degree—was to go sufficiently far underground for the explosion to be wholly or at least partially contained. However, in July of 1957 no wholly or even partially contained underground nuclear explosion had yet occurred. In each of the previously announced shallow underground military shots, the fireball had reached the surface and so had at least seventy-five per cent of the radioactivity. So, while Plowshare scientists were of the opinion that underground shots would alleviate the problems of flash, blast, and fallout, they had no test data with which to work. The Department of Defense soon provided some.

On September 19, 1957, the first completely contained nuclear explosion occurred at the Nevada Test Site. This shot, code named Rainier, had a yield of 1.7 kilotons. (A kiloton of yield is the equivalent of the energy released by 1,000 tons of TNT). Rainier was fired at a vertical depth of 900 feet below the surface of a mesa, with the nearest point on the sloping face 790 feet away. At the firing point 2.5 miles away, the ground shock from the explosion was barely perceptible, although scattered rocks were shaken loose from the cap rock of the mesa for distances of about 0.5 mile on each side of ground zero—the nearest point on the surface to the shot point.

The effect which this ground shock had at ground zero has best been described as follows. Most of us have had the experience of unexpectedly stepping off a curb in the dark. It's startling, frequently painful, but seldom fatal. This is about the sensation that would have been experienced by an observer standing at ground zero, except that he would have felt two bumps.

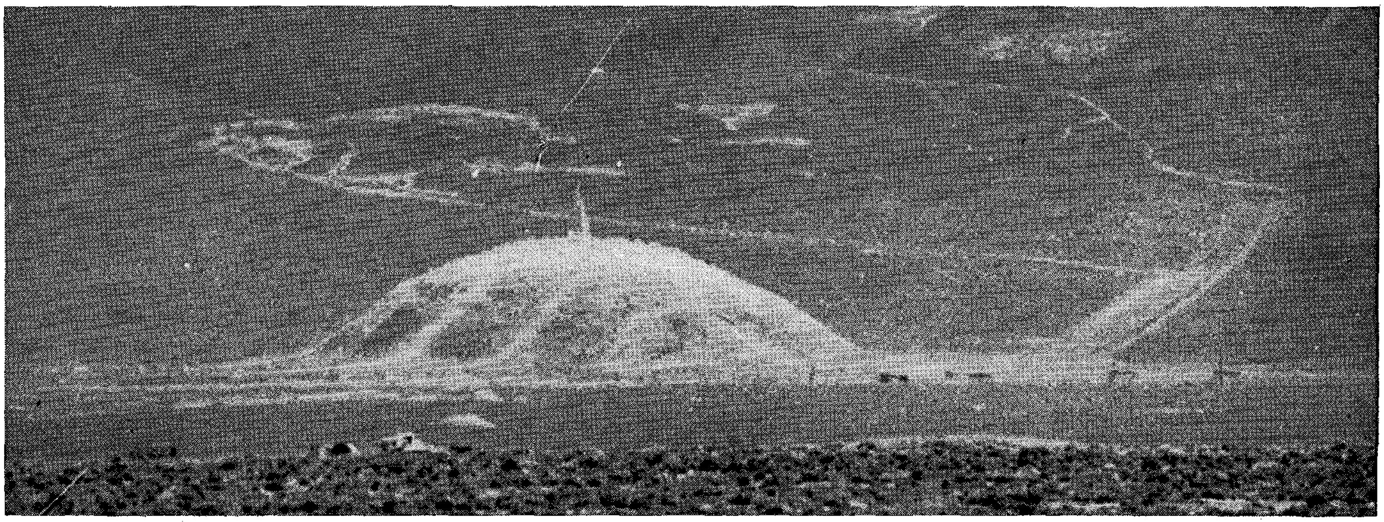
It was several months before a tunnel was once again drilled to the point where the Rainier device had been emplaced. The drilling proceeded with extreme caution because it was considered a possibility that the tunnel would penetrate into an area of very high pressure or radioactivity. These fears proved to be groundless. Although there was a perceptible increase in radiation as the tunnel approached and then reached the shot point, the level of radiation was far below that which was to be expected from the nuclear debris of the device used in the test. It was as though the radioactive debris from the explosion had vanished. Some time later an area of intense radioactivity was discovered about 55 feet below the shot point and Plowshare scientists were able to reconstruct what had occurred immediately after the detonation.

Within a few tenths of a microsecond after the detonation, the Rainier device vaporized in a rapidly growing fireball. During this period, a temperature of ten million degrees Fahrenheit and a pressure of several million atmospheres were achieved. Within milliseconds, a shock wave proceeded outwards vaporizing, melting, and crushing the surrounding rock. This shock wave vaporized a 3-foot thickness of rock—about 100 tons—melted approximately 10 more feet—about 700 tons—and crushed rock out to 130 feet. The cavity reached its maximum radius of 65 feet in about 100 milliseconds.

A quasi-static phase followed. At this point the cavity was lined with about 4 inches of melted rock at a temperature of 2,200 to 2,700°F. The cavity stood long enough—somewhere between 30 seconds and 2 minutes—for much of the fluid rock to flow down the sides or to drip from the ceiling of the cavity. The major radioactive debris from the explosion was contained in this melted rock and, consequently, when the cavity collapsed, most of the radioactivity was deposited in a zone about 35 feet thick at the bottom of the cavity.

In about a minute, the pressure in

Sedan just prior to venting of incandescent gases. That bulge is some 800 feet across.



the cavity dropped to approximately 40 atmospheres. The roof then began to cave in and a chimney of rubble extending up 400 feet from the shot point was formed. About 500,000 tons of broken rock was thus produced.

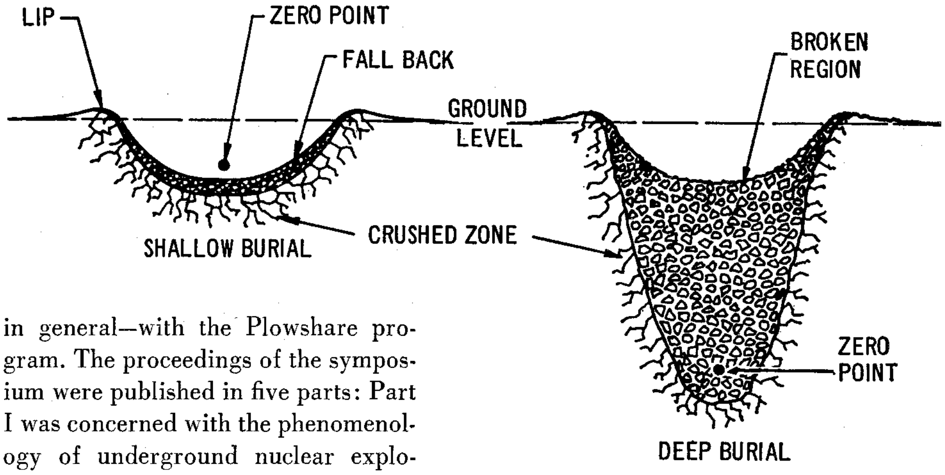
During the exploratory drilling after the Rainier shot it was found that this broken rock was permeable to water. This brought about one of the first suggested uses—other than military testing—for underground nuclear explosives. The leaching of ore by water has long been used as a means of recovering water-soluble minerals. Normally, the ore is transported to the surface and broken up for the leaching process. But if sufficiently large quantities of ore could be broken up underground so that leaching could occur while the ore remained in place, a large portion of the cost of mining would be eliminated.

Although an interesting possibility, this suggested use of nuclear explosives has yet to be demonstrated as being either technically or economically feasible.

The primary purpose of Rainier was to demonstrate the feasibility of testing nuclear weapons underground. The Plowshare studies associated with Rainier were thus secondary. Fortunately, a large part of the results could be—and were—interpreted in terms of possible application in the Plowshare program.

Rainier was only the beginning. In 1958 extensive testing at the Nevada Test Site provided additional information concerning both contained and partially contained nuclear explosions. Much of this information, combined with that from Rainier, was published as a part of the proceedings of the Second Plowshare Symposium held at San Francisco in May 1959. (The First Plowshare Symposium in February 1957 was a classified meeting. As a result of it, the decision was made to formally establish a program to study the industrial and scientific applications of nuclear explosives.)

The Second Plowshare Symposium was held for the purpose of acquainting American industry—and the public in general—with the Plowshare program. The proceedings of the symposium were published in five parts: Part I was concerned with the phenomenology of underground nuclear explosions; Part II dealt with excavation by means of nuclear explosives; Part III suggested possible applications for the recovery of power and isotopes from contained underground nuclear explosions; Part IV considered industrial uses of nuclear explosives in the fields of water resources, mining, chemical production, and petroleum recovery; and Part V explored scientific applications of nuclear explosives in the fields of nuclear physics. seismology, meteorology, and space.



As shown here, shallow and deep detonation of nuclear explosives can give essentially the same crater dimensions. Deep burial, however, gives a much better containment of the radioactive debris from the explosion.

During this symposium considerable emphasis was placed on two future Plowshare experiments: Project Gnome and Project Chariot. Gnome was a proposed 10-kiloton shot in a bedded salt formation near Carlsbad, New Mexico. The explosion was to be for the purpose of providing a basis for an evaluation of the feasibility of power and isotope recovery from underground nuclear explosions. Considerably more will be said about Gnome later in this article.

Chariot, on the other hand, was to be the first full-scale experimental excavation by the use of multiple nuclear explosives simultaneously detonated. As originally planned, Chariot was to be the formation of an artificial harbor in northern Alaska by means of the simultaneous detonation of five nuclear devices. The main bowl of the harbor was to be formed by two 200-kiloton devices buried at a depth of 700 feet and spaced 775 feet apart. The entrance channel was to be formed by three 20-kiloton devices buried approximately 375 feet deep and spaced 408 feet apart.

Extensive meteorological, geological, and ecological studies were made of the remote Chariot site 110 miles north of the Arctic Circle. If everything went well it was thought that the Chariot event could occur as early as April 1961. Although the various studies apparently all showed Chariot to be technically feasible, the project has now been put off indefinitely. The official explanation the AEC gives is that in view of the present dynamic situation, the Commission has deferred for the present any decision to cancel the project or to recommend to the President that it be conducted. The site itself is now on a caretaker status.

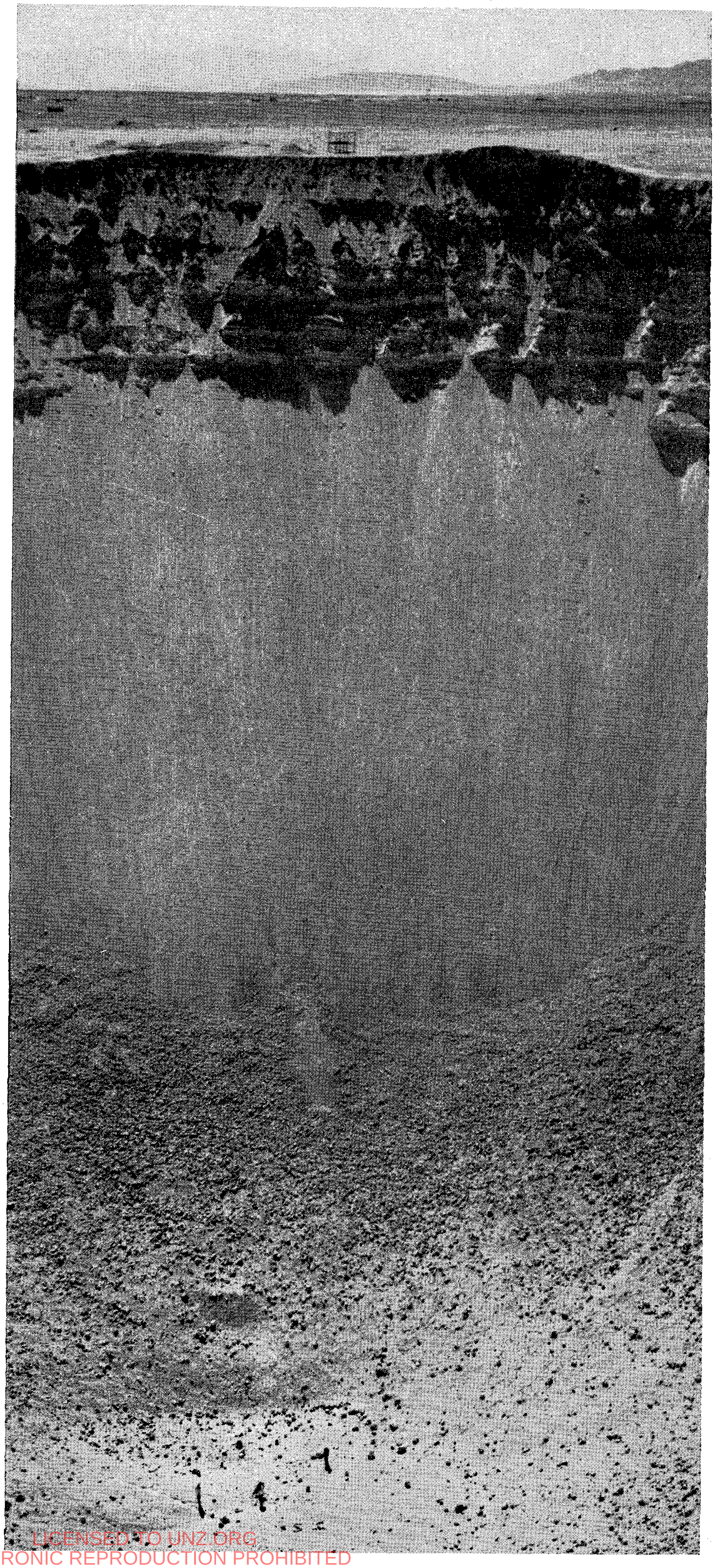
The decision to postpone Chariot indefinitely appears not to have been based on ecological considerations. A second Summary Report issued by the Committee on Environmental Studies for Project Chariot states: "We believe the many reviews of the data, and consultations with many scientific people, warrant the conclusion that if the detonation were carried out the chance of biological cost at the ecological level, including jeopardy to the Eskimos or the plants and animals from which they derive their livelihood, appears exceedingly remote."

It should be noted that there are a minority of scientists who strongly disagree with this opinion. One of their arguments is based on the fact that the residents of certain Eskimo communities now have cesium 137 content in their bodies which is 100 times greater than the worldwide average. (Cesium 137 is considered to be one of the potentially harmful radioisotopes which may be deposited in fallout.) The cesium 137 content of these Eskimos is still well below the established tolerance level, but appears to be rising. The contention of those opposed to Chariot is that a nuclear cratering experiment in the area in which these Eskimos live could only add to this cesium 137 hazard.

Economic and political motivations may have entered into the decision, however. There seems to be little economic justification for constructing a harbor in that particular area of Alaska. The argument has been raised that if Chariot is primarily for demonstration purposes only, it could be demonstrated considerably more cheaply at a less remote site. Also, although the Alaskan site is not extremely close to the Bering Straits, still its proximity is such that the international implications could not be entirely overlooked.

There has been one concrete result of the Chariot studies. More is known about the tundra in that area of Alaska than about any other tundra in the world.

Gnome was destined to meet with more success. On December 10, 1961 it became the first nuclear detonation executed under the Plowshare program. Although a 10-kiloton device was originally programmed for use in Gnome, the device actually detonated had a yield of approximately 3.1 kilotons. The smaller device was used when it was determined that a device of this size would not only still meet the objectives of the experiment but would also reduce the chance of any mishap occurring in nearby potash mines. (The chance that damage



The Sedan crater viewed from the rim. The immense size makes the three men in the crater almost unnoticeable.

would occur in these mines was considered extremely remote even with a 10-kiloton device. As it turned out, the Gnome shot had no noticeable effect on any of the mines.)

Prior to the shot the AEC listed the experimental objectives as:

1. Explore the feasibility of converting the energy from the nuclear explosive into heat for the production of electric power.
2. Investigate the practicability of recovering useful radioisotopes for scientific and industrial applications.
3. Expand the data on characteristics of underground nuclear detonations to a new medium (salt) which has marked differences from the tuff (a volcanic rock) at the Nevada Test Site in which previous underground detonations have been conducted.
4. Make neutron cross-section measurements which will contribute generally to scientific knowledge and to the reactor development program.

Reports issued subsequent to the Gnome event refer to five objectives of the experiment. The fifth objective was to make seismic measurements to aid in the understanding of differences between underground explosions and earthquakes, and, since Gnome was detonated in a region of very few seismic disturbances, to obtain new knowledge about the earth's seismic model. In addition, a variety of mineral and organic samples were arrayed at various distances from the shot point so that they might be subjected to a range of shock pressures in order to study the effects of the explosion on them.

Gnome was planned to be a wholly contained explosion and the AEC went to great lengths to impress on the residents of the surrounding area that there was little or no chance of radioactivity reaching the surface. In a pamphlet issued prior to the shot the AEC stated: "Although the probability of the experiment venting radioactivity into the atmosphere at the time of detonation is so low as to approach the impossible, precautions are being taken to cover even this unlikely situation."

Fortunately for all concerned, these precautions were taken—for Gnome did vent radioactivity to the atmosphere. The amount which reached the surface was not large and it was mostly short-lived; but, appearing as it did in a rather visible cloud of steam, it belied some of the earlier statements of the AEC.

Gnome was detonated at a depth of 1,184 feet. The device was emplaced at the end of a buttonhook-shaped horizontal tunnel a distance of 987 feet from a vertical shaft to the surface. The first 900 feet of the tunnel was straight while the remainder was curved into a buttonhook shape; the design was such that the buttonhook would close following the detonation and thus contain the explosion. It didn't work out that way.

As in the Rainier event, the cavity apparently was formed within the first 100 milliseconds following detonation. However, the Gnome cavity was considerably larger than that of Rainier, primarily because of the higher yield of the Gnome device. Its radius varied but ranged on the average from 55 to 65 feet.

Events following cavity formation in Gnome were markedly different than Rainier. Whereas the Rainier cavity apparently collapsed within a minute of its formation, the Gnome cavity remained intact—and still is at the time of this writing. Some ceiling collapse and implosion from the walls occurred within about three minutes after the explosion; after that there was no significant change to the cavity itself.

Some 2,400 tons of salt were melted by the explosion. Approximately 13,000 tons of salt rock which imploded or spalled from the walls of the cavity became intimately mixed with this melt. This mixture in turn was covered by an estimated 15,000 tons of rock which collapsed from the ceiling. The resultant cavity was roughly hemispherical in shape with an irregular flooring and walls colored in shades of blue, green, and violet. This coloring resulted from the action of radiation on the salt.

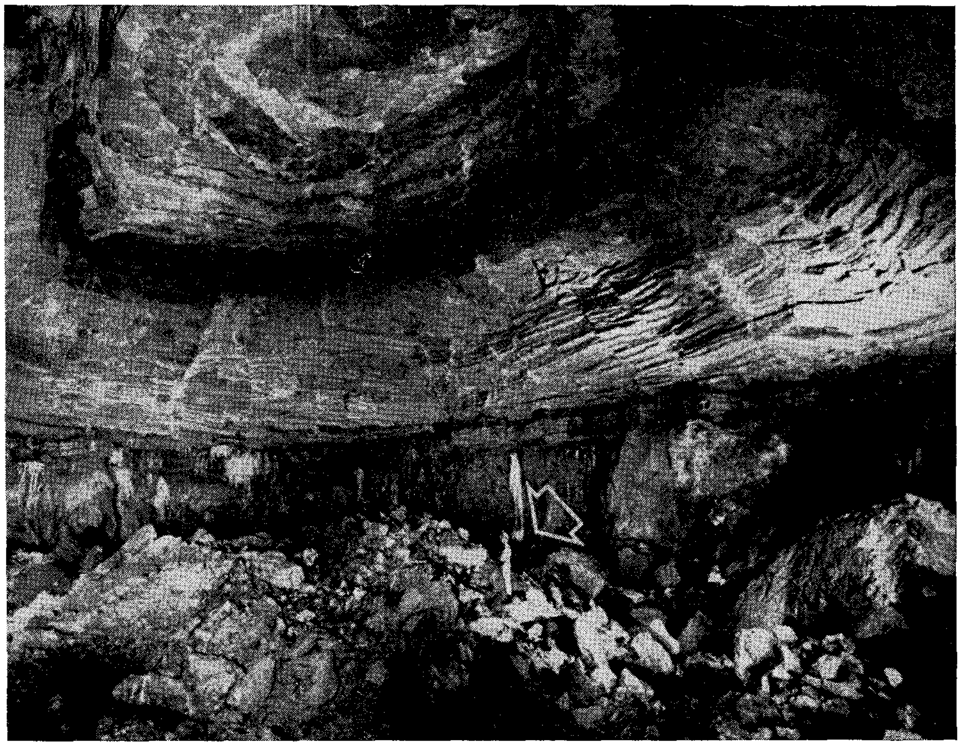
Less than a minute after the detonation, radiation was detected underground in the emplacement tunnel, and approximately seven minutes after detonation, gray smoke and steam leaked from the shaft opening. This venting was caused by the very rapid breakup of the rock salt surrounding the shot area. This allowed a fissure to open between the cavity and the main tunnel which had partially collapsed —but not sealed—for a distance of 200 feet from the shot point.

As a safety precaution, a plug and filters had been installed in the tunnel about 900 feet from the shot point. The plug contained most of the overpressure caused by the venting from the cavity, and the filters stopped almost all of the particulate radioactivity. The steam which did escape contained mostly short-lived gaseous radioisotopes.

The Gnome experiment had mixed results. It was not the failure implied by some news reports shortly after the event. Neither was it the success that some scientific reports made it appear. Rather it provided much—but not nearly all—the data hoped for. The greatest single failure of Gnome was the venting which caused some data for three of the five experimental objectives to be lost. The radioactivity release—although embarrassing in light of previous statements—was minor and short-lived.

Prior to Gnome it was thought that nuclear explosions in salt represented the most promising method by which the energy of a nuclear explosion might be recovered for power purposes. Afterwards, the AEC came to the tentative conclusion—as stated in its 1962 status report—that the use of nuclear explosives for power production in salt cavities is neither technically nor economically attractive. This conclusion was reached although the venting prevented a comprehensive thermal energy measurement program which had been planned. By other means, however, the steam produced by the explosion was found to contain large amounts of corrosive and acid materials which could play havoc with steam turbines. Also, the mixing of 13,000 tons of salt rock with the melt formed by the explosion distributed the heat over such a large mass that recovery would have been impossible.

Gnome did apparently demonstrate the technical feasibility of recovering isotopes produced by nuclear detonations in salt. The economics of it though is another matter. Studies of the melt and associated rubble showed that more than ninety-nine per cent of the nongaseous isotopes produced by the Gnome shot were concentrated in impurities in salt. This was especially true of the isotopes of uranium, plutonium, and the translutonium elements such as americium and curium. These isotopes remained with the insoluble fraction when salt samples were dissolved in water. A treatment with a relatively inexpensive acid—hydrochloric or nitric—then makes possible the extraction of most of the isotopes desired.



The Gnome cavity. The relative size of the cavity is best shown by comparison with the man shown standing in the lower center of the photo.

The volatile isotopes were distributed in the steam and—again because of the venting—could not be recovered. The most valuable of the volatile isotopes formed by a nuclear explosion is probably the radioactive isotope of hydrogen called tritium which—because of its short half-life—does not occur naturally. Tritium plays an essential role in thermonuclear reactions.

Because of the venting, neutron wheels—wheels containing many foils of various metals which were rotated at high speed at the time of the explosion so that neutrons of various energies might impinge on them—used in the neutron cross-section experiment were not recovered until six days after the shot. As a result, some of this data was compromised. Even though the venting caused some of the data to be questionable, analysis of samples exposed to the neutrons emitted by the Gnome shot has brought forth a changed understanding of the fission process. The AEC states that experiments of this type are of great scientific value and will be conducted in connection with future contained nuclear detonations.

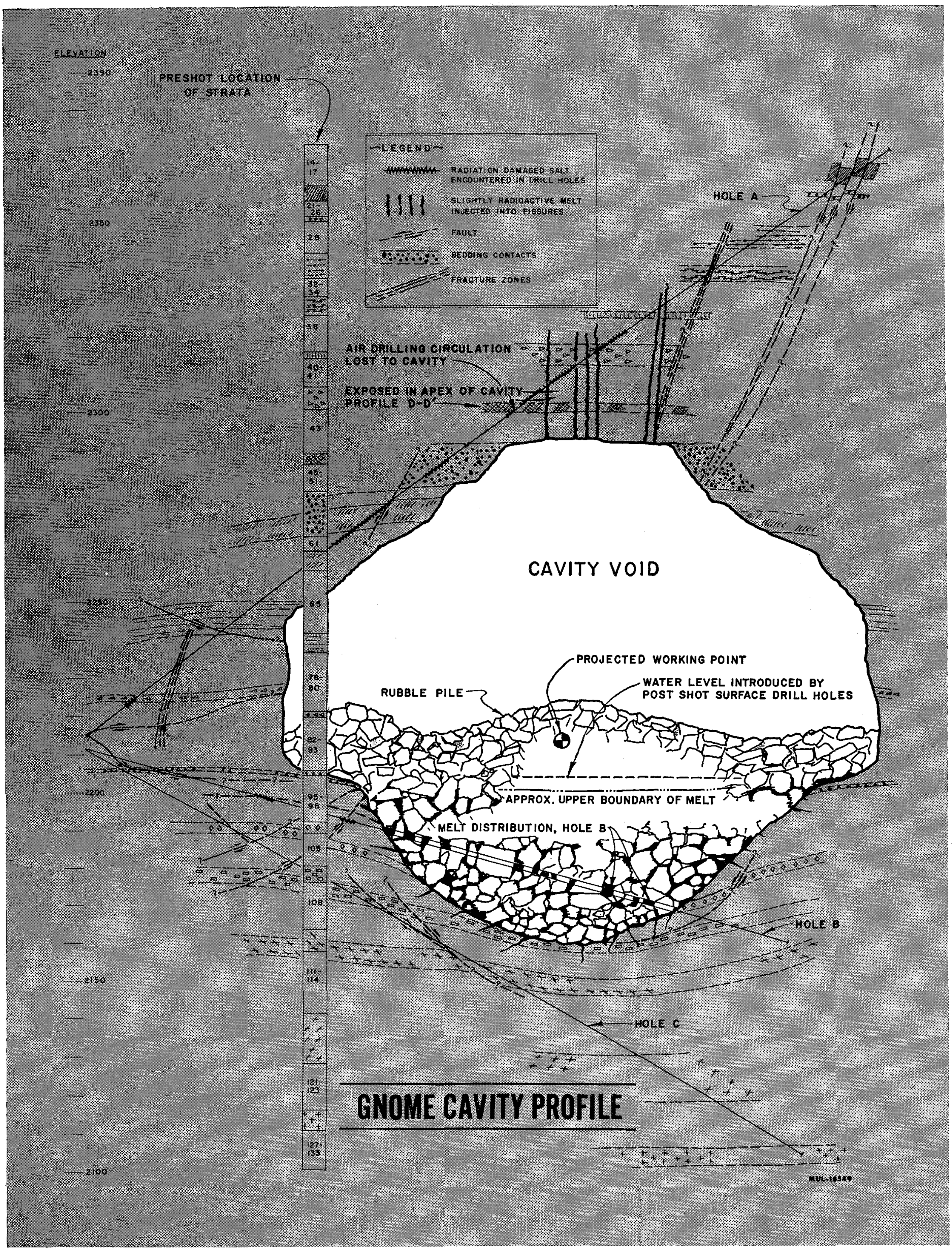
Needless to say, Gnome provided a large body of data concerning the effects of a nuclear explosion in a salt environment. Previous detonations in volcanic tuff and desert alluvium at the Nevada Test Site had provided a general understanding of the interaction between nuclear explosives and rock materials, and theories concerning this interaction had been developed. The Gnome shot was an excellent test of these theories, since the physical and chemical properties of salt are greatly different than those of tuff and alluvium.

The seismic measurements portion of the experiment was also quite successful. In particular, it provided data which showed the so-called Moho discontinuity to be 30 miles below the earth's surface in the central United States. This information was of particular value to geophysicists studying the earth by means of seismic measurements.

The Plowshare program has thus far been conducted along two broad lines. One is concerned with applications and effects of contained nuclear explosions; Project Gnome was an example of this type of experiment. The other has to do with earthmoving and cratering; the Sedan shot of July 6, 1962 is an example of this line of endeavor.

Sedan, with a yield of 100 kilotons, was one of the larger nuclear explosions to occur in the United States. Its purpose was to extend knowledge of cratering effects to yields in the range of 100 kilotons, since the majority of previous cratering experiments had been limited to yields well below this. Most large excavation projects would require explosives with yields in the range of 100 kilotons.

The shot point for Sedan was 635 feet underground. It was thought that detonation at this depth would result in a crater of almost maximum size, but yet would still allow less than about five per cent of the radioactivity produced by the explosion to escape. A thermonuclear device in which less than thirty per cent of the energy release came from fission was used. Fallout was expected to be less than that


ELEVATION
2390
2350
2300
2250
2200
2150
2100
PRESHOT LOCATION OF STRATA
LEGEND
RADIATION DAMAGED SALT ENCOUNTERED IN DRILL HOLES
SLIGHTLY RADIOACTIVE MELT INJECTED INTO FISSURES
FAULT
BEDDING CONTACTS
FRACTURE ZONES
HOLE A
AIR DRILLING CIRCULATION LOST TO CAVITY
EXPOSED IN APEX OF CAVITY PROFILE D-D'
CAVITY VOID
PROJECTED WORKING POINT
RUBBLE PILE
WATER LEVEL INTRODUCED BY POST SHOT SURFACE DRILL HOLES
APPROX. UPPER BOUNDARY OF MELT
MELT DISTRIBUTION, HOLE B
HOLE B
HOLE C
14-17
21-26
28
32-34
38
40-41
43
45-51
61
65
78-80
82-93
95-98
105
108
111-114
121-123
127-133
MUL-16549

GNOME CAVITY PROFILE

produced by a 2-kiloton surface shot.

The results were spectacular. A roughly hemispherical dome of earth, 600 to 800 feet in diameter, rose to a height of 290 feet within seconds after the detonation. At this point, incandescent gases vented to the atmosphere. A tremendous mass of earth and rock rose to a height of 2,000 feet before falling back to the ground and forming a base surge which eventually expanded radially to a distance of approximately 2.5 miles crosswind and 2 miles upwind. (Base surge is low cloud which often boils out for a considerable distance from the central cloud of a partially contained or surface explosion. It plays an important role in nuclear excavation because it contains the majority of the prompt fallout from the detonation.)

Within several minutes, the central cloud rose to 12,000 feet and eventually reached a maximum height of 14,000 feet before the prevailing wind carried it off in a northeasterly direction. In the next twenty-four to forty-eight hours it was to leave evidence of its passing in Utah.

Sedan formed a massive crater which had a maximum depth of 320 feet and an average diameter of 1,280 feet. The height of the crater lip ranged from about 20 to almost 105 feet. About 12 million tons of earth were displaced. If nothing else, Project Sedan proved that nulear explosives are capable of throwing a tremendous amount of dirt around.

One of the primary considerations in the use of nuclear explosives for industrial excavation would be the amount of radioactive debris left lying around after the explosion. For this reason, one of the more important objectives of Sedan was the determination of the amount, displacement, and kind of radioactive debris formed. The AEC stated in its 1962 status report that decay of radioactivity from nuclear detonations such as Sedan is very rapid. An example in support of this was that workers returned to the Sedan crater lip for short periods of time five days after the detonation.

On the other hand, recovery of ejecta samples was delayed until twenty-three days after the shot because of the high radiation levels existing at the ejecta stations. (Ejecta is the material thrown from the crater by the blast. One of the objectives of the Sedan experiment was an accurate determination of the amount and displacement of ejecta.)

In its final report on weather and radiation measurements conducted for Project Sedan, the United States Weather Bureau gave ten per cent as a reasonable estimate of the amount of radioactive material deposited in the fallout pattern by Sedan. The amount of solid particulate fallout was less than predicted in the closein prompt fallout area and more than predicted by about a factor of 2 further out. This was to have some unforeseen consequences for the Salt Lake City area.

When speaking about fallout, the one thing that appears to be common knowledge is that we are against it. Other than that, conceptions vary quite widely. Therefore, at this point some more precise definitions are in order.

Fallout is the process or phenomenon of the fallback to the earth's surface of particles contaminated with radioactive material. The term is often applied in a collective sense to the contaminated particulate matter itself—which is the manner in which it is most often used in this article. Early or prompt fallout is defined somewhat arbitrarily as those particles which reach the earth within twenty-four hours after a nuclear explosion. Delayed fallout consists of the smaller particles which may ascend to great heights and travel to all parts of the earth before descending.

In the case of Sedan, intense fallout was confined to approximately 2 miles upwind and crosswind, and 4 miles downwind from ground zero.

During July 1962, Utah received more than its fair share of fallout. In a fifteen day period beginning on July 7th, clouds from five nuclear tests passed over the Salt Lake City area. Three of these clouds are known to have deposited residual fallout activity in the vicinity of Salt Lake City. One of those clouds came from Sedan.

The radioactivity deposited on the Salt Lake City area was primarily in the form of an isotope of iodine known as iodine 131. It now appears that the AEC and DOD failed to foresee the amount of iodine 131 which would be produced by these tests, otherwise they probably would not have occurred in such a rapid sequence (July 6th, 7th, 11th, 14th, and 17th).

Again in its 1962 status report the AEC declared that the Sedan experiment contributed only a small part of the iodine 131 found in Salt Lake City milk during July and August of 1962. What constitutes a small part is more difficult to decide. A report published in the August 16, 1963 issue of *Science* stated that the Sedan test was responsible for ten to thirty per cent of the iodine 131 uptake in Utah resulting from these tests. It further reported that very little iodine 131 appeared in the milk of cattle eating exclusively feed which had been stored prior to the Sedan explosion of July 6, 1962.

The AEC minimized the possible danger by stating that while the peak values of iodine 131 in milk in the Salt Lake City area were relatively high, the average levels over a period of time were too low to constitute a significant health hazard. Sedan, however, demonstrated that—at least as of 1962—fallout was still a problem for the Plowshare program to cope with.

This is not to say that it is a problem which will forever remain an adjunct to the use of nuclear explosives. Considerable gains have been made in reducing the amount of energy released by fission in nuclear explosions. Since fission reactions are responsible for most of the fallout now associated with nuclear explosives, any reduction in fissionable material results in less fallout. The ultimate success in this

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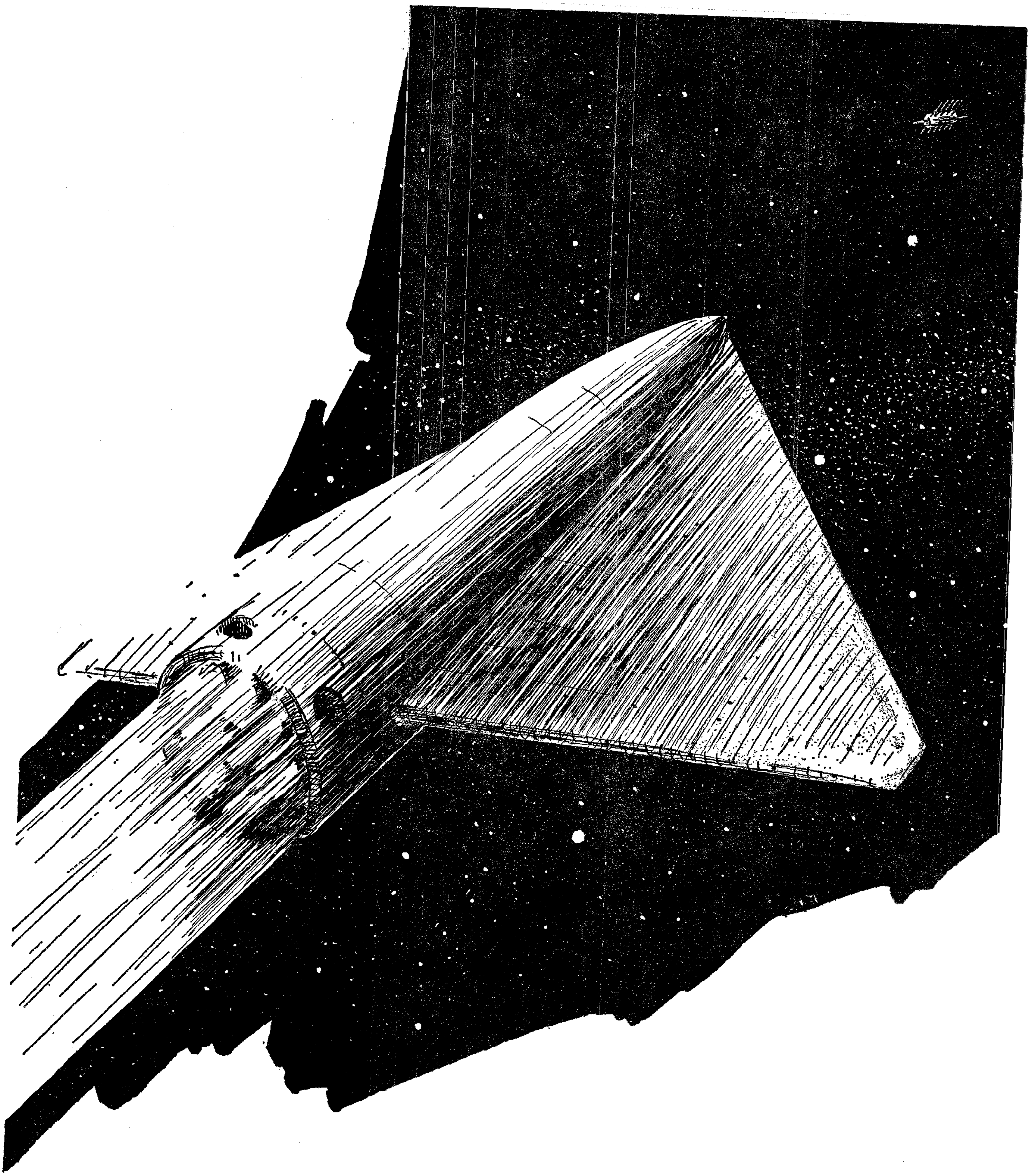


STUCK | JOHN BERRYMAN

According to the fable,
B'rer Rabbit had trouble with Tah Baby,
when he attacked it.
This little trap wasn't quite the same . . . but yet . . .

ILLUSTRATED BY STEVEN VERENICIN

The sign on the door to my office says "Seaman Associates—Solid State Physics." That means that if you cross my palm with silver, I'll give you some advice. Some days people come to me with their space-age problems. Some days I just sit there and read about rockets and communications satellites in the trade journals.

This Monday a caller broke in while I was looking over some attractive ads for physicists from Boeing and General Dynamics, just a little before lunch. He was compactly built, a little past thirty, and with a military-brush haircut. He stood with a straightness that said he hadn't been out of uniform too long. He carried a leather dispatch case about thick enough to hold *Time* magazine or a couple of secret documents. That meant he thought he was somebody. The bigger the wheel the thinner the case.

"Dr. Seaman?" he snapped, as if he were calling me to attention. I took an immediate dislike to him.

"*Mike* Seaman," I said sourly, putting my cigar down. The hell with that "Doctor" jazz. I didn't bother to get out of my swivel chair.

Setting his dispatch case down, my caller drew a pin-seal wallet from his jacket, extracted a card and took two precise steps to the edge of my desk. He handed me the card. I read it. It said he was Richard Busch, an employee of the United States Government, never mind what agency. It's supposed to be a big fat secret.

"We have urgent need for your services at Cape Kennedy, Seaman," Busch said brusquely. "We'd like you to come at once."

I tossed the card back to the top of my desk, and Busch picked it up. "No thanks, Busch," I said. "I tried it once. I didn't like it." I picked my stogie from the ash tray and puffed. It was still lit.

"There's no need to be flip, Seaman," he said, sucking in his gut and drawing his chin back.

"There's no need to be pompous, either, Busch," I said. "I sell advice. I don't go tearing around the country just because some card-carrying wise guy comes storming into my office. You got a problem? Tell me what it is. Maybe I can help you." I blew smoke at him.

He took a deep breath and remembered to shift gears. It would always be hard for him to deal with civilians. He wasn't used to getting along with people. Well, he'd learn to get along with me.

"Sorry," Busch said, with a degree of humility I'd never have guessed he had in him. He looked at the chair and nearly asked for permission to sit down. Well, at least we had established the peck-order.

He stepped back to pick up his dispatch case, sat down across from me and put the case on his knees. Opening it with a key, he drew out a manila envelope, apparently all the case contained, and pulled an 8 x 10 glossy photo from it. I reached for it and looked the picture over carefully.

Judging by its pronounced grain, it was an extreme enlargement. The object in its center, against a dead-black background, had that one-sided lighting that said it had been photographed in deep space, with sunlight striking one half, and leaving the other half completely in shadow. The object had a squatty central body, more or less cylindrical, although the coarse grain of the enlargement made it a little difficult to tell. Jutting out from the central body were a number of long, extremely thin arms supporting at their ends what I took to be antennae. Some were round and hinted at being bowl-shaped. Some were rectangular and looked flat. They pointed this way and that, not all focused on the same object. It was plain, too, from the spider-web fragility of the object, that it had been photographed in the weightless free-fall of orbital flight. Nothing so tenuously built could have held together under the strain of gravity.

I looked up and across my desk to Busch's expressionless features. "Well, well," I grinned around the butt in my teeth. "That's a regular old Daddy Long Legs, isn't it?"

"You know what it is, Seaman?" Busch asked.

I shrugged. "A space probe, I guess. It's in space, sure enough, and you got this shot with a telescope of some kind."

He nodded shortly. "We fired a missile with a 'scope to get close enough to make that picture," he said. "Can you tell me what its purpose was—what it was built to probe or sense?"

"From this picture?" I said, irritably. "Don't be silly. Of course not. What do *you* think it's probing?"

"We're stuck," he admitted, brushing at his close-cropped hair. "We don't know, and we want to find out. That's why we want you to come to the Cape and join Project Stymie."

"Where'd you get the picture?"

He waved a hand vaguely. "Oh, about over North Dakota," he said, getting cagey the way these secret agency guys will do if you let them. "This was the fourth probe that has made a pass over the country. Some unfriendly power is orbiting these things, and they come sneaking over us at odd intervals. We expect more of them."

I scowled at that one, tipped my swivel back and braced one foot in an open desk drawer. I puffed smoke and thought about it. "What do you mean, 'some unfriendly power'?" I asked at last. "Don't you know where it was launched? You've got all kinds of infrared sensors in orbit to pick up booster exhausts."

He paused before he answered. Apparently there was only so much he was allowed to tell me. "Yes," he said carefully. "We know where it was launched, where all four of them were launched. From a submarine in the middle of the Pacific Ocean. Which tells us nothing about the country of origin. It could be any of the nuclear powers."

"Especially the United States,"I grinned nastily. "We invented the technique."

"Nonsense," he said stiffly. "Would a closer, clearer picture help?" he asked, getting back to what he wanted.

"No," I said, pressing the cigar out in my ash tray. "The only way you can figure out what this probe is sensing is to take it apart and examine its innards."

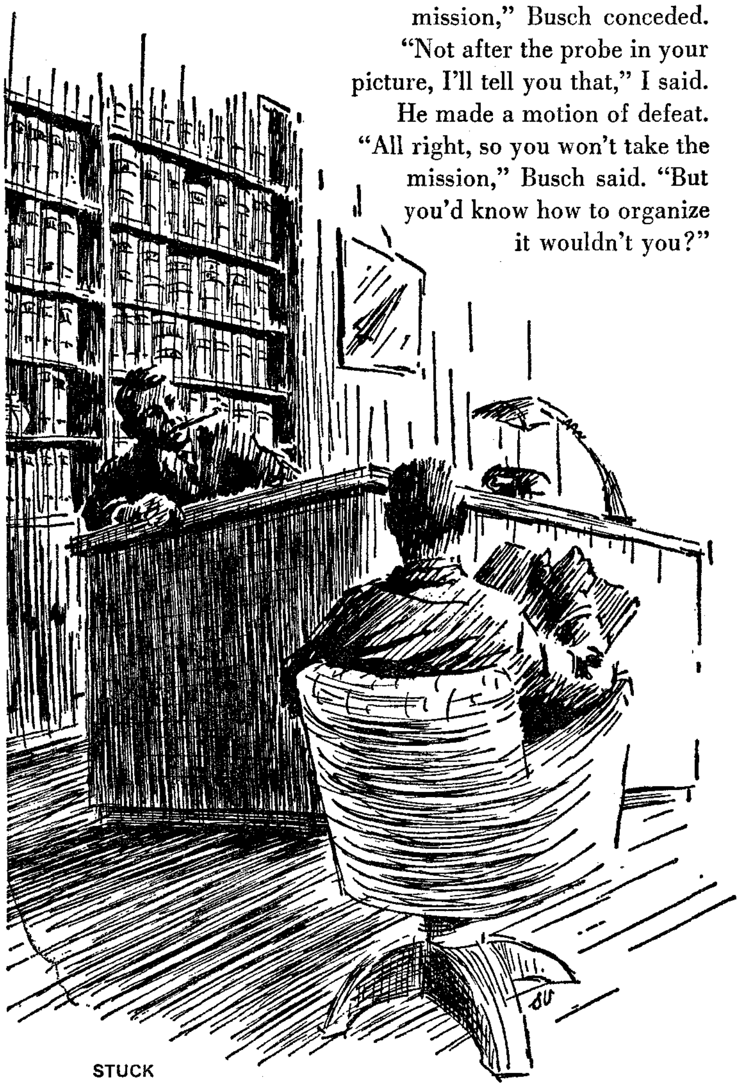
He gave me his first smile, the small, economy size. "We thought it would call for a trip into space," Busch said. "You've done some of that, haven't you, Seaman?"

"I've done all of that I ever intend to do," I snapped. "Six trips to repair communications satellites for Communications Corporation. And if I ever took another mission, it wouldn't be to chase after a satellite launched by some hostile power. Only a nut wants to stooge around in a spacesuit in free-fall, anyway."

"They were fearful you wouldn't take another mission," Busch conceded.

"Not after the probe in your picture, I'll tell you that," I said.

He made a motion of defeat. "All right, so you won't take the mission," Busch said. "But you'd know how to organize it wouldn't you?"



"Of course. Can't think of any reason why I couldn't."

He started putting the picture back in its envelope. "My assignment is to bring you back to the Cape with me to help set up Project Stymie."

I gave him a raised eyebrow.

"My Agency has the assignment," he said. "The task is to determine the purpose and country of origin of these probes."

"So as to stymie the effort?" I asked.

"That, and perhaps something more. My agency will be paying your fee."

"That's nice of it. I'd rather work from here. Advice doesn't have to travel to be effective."

He got the case back on his knees and put the envelope in it and locked the latches. "There's more to the problem than I've told you," he said reluctantly. "And we have only a week until we expect the next probe to come through. Our radars got good fixes on the launch in the Pacific, and we have the orbit down pretty solid. We want you at the Cape."

I thought about it. The Government had never hired me directly. My work had come from the contractors, like Western Electric, Boeing and McDonnell. There's prestige in working for the front office, and prestige is about ninety per cent of success in the consulting racket. Direct Government work would be a nice scalp at my belt.

But there was another side to it. With my deep-space experience, once they got me down there, they'd start pressure for me to take the mission. That's the way it had been at COMCORP. "We need you on this mission, Mike. You're the boy with the knowhow. You are the guy who can do it."

Well, I wasn't about to climb in another bird and get boosted into space in chase of a hostile probe, no matter what the reason.

"You're hiring my advice—*just* my advice?" I insisted. "No nonsense about my taking the mission?"

"If you insist. Just advice."

"Let's go," I said, feeling sure I'd regret my decision.

We made a quick stop at my place on the East Side for some shirts, while Busch kept the cab waiting, and then made it through the Tunnel and out to the airport. They had one of those cute little Lockheeds with four jets in the tail waiting for Busch and me. Busch had a fatter dispatch case on board, which he quickly got open. He spent most of the two-hour trip to the Cape talking over the radiophone with his boss. I didn't pay much attention to it, preferring to smoke and snooze in the whining quiet of the cabin, and think over the problems that would be thrown at me in Florida. After all, I had to earn my fee.

There was a Jeep and driver waiting for us when we landed at the Cape. That's one thing about a Government job, there's always a Jeep available. Our driver had some sense of the urgency of what we were doing, and drove like the devil.

"The meeting will be in session by the time we get there, Seaman," Busch yelled above the racket of motor and gearboxes as we tore down the highway. He hung onto the Jeep with one hand and his two dispatch cases with the other. He was a real wheel, a two-case man. "I set the meeting up while we were flying down."

I knew he had been doing something. He had sure given a lot of orders over the 'phone. "Nuts," I shouted back, holding on tight. "What ever got accomplished in a meeting? You must have some guy down here who yelped for help, or you wouldn't have come after me. Take me to *him. You* go to the meeting."

Busch didn't like it, but I was balky. The result was that he had the Jeep take us to the air-conditioned comfort of the ad building, and he led me down a corridor to the two-by-four office of a skinny, stoop-shouldered young guy named Fred Kupek. The sign on his door said, "Orbit Section."

"Beat it," I told Busch. "Go to a meeting." He wanted to argue, but remembered the meeting was waiting for him, I guess, and left me and Fred together.

He was standing, hugging his arms to his hollow chest, behind his desk. I went over to him. "Did you let out a bleat for some help on this Project Stymie thing?" I asked him.

Fred nodded, a sort of a nervous jerk of his head. "If you're Seaman," he said rapidly. "I asked them to get you. I heard about your work with COMCORP. We need you to go after that probe. Nobody here knows how." His words spilled out after each other.

I started back out. "See you in New York, Fred," I sneered. "I told Busch I wasn't flying any mission for you guys."

He conceded defeat and came rushing around his desk to grab me by the elbow at the door. "That's what they said," he told me quickly. "Damn, and we really need an experienced man. All right, Seaman. We'll settle for your advice."

We kind of calmed down after that and sat down on opposite sides of his desk. "Our problem is a very simple one," Kupek told me. "The idea is to intercept one of these probes, take it apart and figure what it is probing, and come back home. We can't figure how to do it in the time we've got."

"A week isn't time enough to point up the launch, you mean?" I asked.

Fred shook his head, bending his round shoulders as he leaned his elbows on his desk. "No, not that. These probes are shot in a sneaky orbit. They fire these things, somewhere out in the Pacific, just about straight up out of the ecliptic, due north. The orbit is a long, thin ellipse, with Earth as one focus, of course. It's a twenty-day affair. But on the way back down, they have a booster which fires and gives their bird a lot more speed, so that from our vantage the orbit changes from an ellipse to a hyperbola. The probe zips down over us from the north, in a close, grazing pass, only about fifty miles high, curves around due to the attraction of Earth, and heads straight out for the Sun."

I got the point. "Well," I said. "So if you fire your own bird to intercept that hyperbolic orbit, you are diving straight into the Sun for whatever time it takes you to open the oyster and see what makes it tick!"

"That's it," Fred said. "You see the problem?"

"Sure. Getting back. I suppose that in the time it will take to analyze the probe you get past the point where your retro fuel can slow your bird down enough to make re-entry possible?"

He nodded, clenching his fist. "You've got it," Fred said in a rush. "They'd be *stuck* out there. What's the solution? How can we cut analysis time down? How can we short-cut that hyperbolic orbit?"

I got up and walked to the window to look out over the NASA installation while I lit a cigar. I could see several birds on launch pads over in the operations area. A couple 'copters were chopping up and down the beach, doing those pointless things that military aircraft always seem to be doing.

"You can't handle it the way you want to," I said, blowing smoke. "My own experience taking junk apart out in space says that it's slow work. And analyzing strange circuits and the little black boxes hitched up to them is ten times tougher. You can't do it that way."

"You mean, we can't solve the problem?"

"You can't stay in that hyperbolic orbit, that's a cinch. So don't. After you intercept the probe, why not bring it back down to Earth for study? Won't one of the vehicles you use to study the permanently orbiting space stations handle that kind of a mission? All you need is some kind of a cargo hold."

Fred got up from his posture chair and came over to my side at the window. "It was considered," he said, slumping. "The gang in charge of the vehicle said it couldn't be done."

"You mean, they couldn't see how to do it," I growled, clenching down on my stogie. "It's purely a technical problem. Nothing the matter with it in theory."

"Of course not," Fred said. "Theoretically it's the right way."

"Well," I said. "I'm the guy in charge of 'how to.' Take me to meet the guy who says it can't be done."

After getting me the right kind of pass to wear, Fred rustled up a Jeep and took me out to Pad Fourteen in the Operations Area. They made me ditch my cigar at the gate.

The guy who said it couldn't be done was one of those quiet, understated test-pilot types with no more nerves than a milch cow. His name was Ralph Burris and he was overseeing the assembly of the fuel grain for the first stage of a really huge bird when Fred pulled the Jeep up to a screeching halt by the gantry.

We walked across the apron to where Burris stood, hands on hips, watching what was going on. Freddy made the introductions. "Seaman has the same idea we talked about, Ralph," he explained. "He thinks the trick is to bring that probe back down in the cargo hold of something like Vehicle Lambda."

Burris looked at me for a moment without expression. "Wouldn't work," he said. "You'd wreck the ship."

It was my turn. "Explain the problem," I said.

He looked at me thoughtfully before speaking, which I was to find was his habit on most occasions. He was a guy who thought first. "No offense, Seaman, but you're an amateur. Space flight isn't like driving a car or running a boat. You've got other problems."

"Name any three," I suggested, a little tired of being patronized. I would have bet I had made more missions than he had.

He shrugged. "I'll just name one. It's enough," he said, after his usual pause. "We pull about eleven gees on reentry. How are you going to stuff a probe weighing several hundred pounds, of a shape we can scarcely guess, into a hold and keep it from tearing through the bulkhead when we hit the atmosphere? You just can't brace an odd-shaped thing like that in anything built as lightly as a satellite. It will wreck the ship on deceleration."

"That's not a theoretical difficulty," I said. "Purely a practical problem."

He looked at me while he digested that one. "It will kill you just as fast," he said.

"If you don't lick it. Why not lick it? It's a technical problem. Let's find the technique."

"You find it," he said. "I'm busy."

"Nothing hard about it," I said. "Want to hear it?"

He really didn't, but he turned back to me. "All right, Seaman. How would you brace that probe in the hold?"

"With polyurethane foam," I said. "It's light, resilient, and we can alter its mechanical strength to suit us by controlling bubble size."

He shook his head sorrowfully. "And how are you going to whittle it to fit the probe you want to pack in it?" he scoffed. "You'd be a week making a good enough fit."

"Whittle, hell," I snapped. "Squirt the foam into the hold in liquid form, let it bubble and set up solidly around the probe. You can steady the thing by hand in the center of the hold so it's completely cushioned. It isn't going to weigh anything out there in orbit."

He gave me the longest pause of all. The little wheels inside his head, which were slow to start, and which turned at a rather deliberate speed, were turning.

"It might work," he said, after about two minutes. He nodded several times, which I gathered was his way of showing extreme enthusiasm. "Suppose you and I try it, Seaman," he suggested.

"You didn't get the message, either," I said. "I'm not flying any missions with you guys.'

That got a rise out of him. His impassive face creased in a scowl. "Why not? I thought you had made several flights for the Communications Corporation."

I grinned nastily at him. "I'll say I have," I agreed. "And I'm not making any more."

"But why not? This is a perfect job for your skills."

"So that's what determines what a guy does?" I snapped. "Just because I'm capable of diving off the Brooklyn Bridge doesn't mean I'm about to try it!"

"You're simply *scared!*" he said, amazed.

"Of course I'm scared," I said. "Am I supposed to be embarrassed about it?"

"It's not a case for embarrassment," Burris said quietly. "We're all scared. Who wouldn't be? But simple fear over the dangers of space is not enough excuse to avoid your patriotic duty."

"Don't wave the flag at me, Burris," I snarled. "So you guys are curious about what some other country is curious about. It will take more than that to get me back into space."

Burris looked thoughtfully at Freddy. "I think he should talk to Busch, Fred," he said at last. "He plainly doesn't know the whole story."

I never should have listened to it. Oh, it was a good story. "This isn't a case of idle curiosity, for the love of Pete," Busch said coldly, when we were back in Fred's office. "We have our own probes, and we have probed as deeply as possible the offense and defense of every nuclear power. No, it's this: If we were to know what facets of our defense cause the most concern to some enemy, we'd be able to fill out our knowledge of his whole *offensive* complex. This is a case of finding out what we're up against in the event of war. The piece of knowledge that you can bring back might mean ten million lives in the event of attack."

"Send one of *your* men," I suggested.

"We simply haven't got anybody with the combination of knowledge that you have as a physicist, and the experience of working with equipment in space that you've gained in making actual flights. You are the man who can assure the mssion's success," Busch hammered at me.

"No."

"Is it money?" Busch asked insultingly. "Are you just holding out for more money?"

I shook my head.

"Would more money *help?*" he insisted. Oh, that was an insidious attack.

"It would help," I said weakly, and that was a big enough chink in my armor. Somewhere there I said. "Oh, the hell with it. I'll take the mission! Now shut up and leave me to my grief."

People were slapping me on the back and making me feel like a fool. It had been a busy Monday.

Tuesday began the rat-race of pointing up the launch in time to meet an expected Sunday blast off. Burris' work with the first stage, of course, had been an important preliminary. There were two other stages to be assembled on top of the booster, and then the vehicle.

As Fred Kupek had predicted, Vehicle Lambda was the choice.

It was a big kite—a huge delta wing with a squarish fuselage stretching the whole length and sticking out past the trailing edge. The nose was pointed and held a control room for a crew of two. The stern was all solid-fuel rockets, as well as tanks of steering fuel, heliox and water. In the center was a hold, with a curving hatch that slid to open, in which we proposed to bring back the probe we were setting out to intercept.

My first job was to find the spacesuit I had used to make my earlier missions. It was still at the Cape, and I hadn't put on enough fat in six months of consulting work to change anything. They sent a jet to Newark to get my tools, which were back in the lab I had used to run for COMCORP in Kearny. By Friday things were in pretty good shape, and our radars all over the world were pulsing and trying to get their first echo from the probe that was due to come hurtling down from north of the ecliptic some time Saturday or Sunday.

Burris, as he had suggested, had been picked to pilot the mission from the start. We had done our dry run work in the control room, and were pretty well geared-up to work together. This would be his fifth mission, which, as I suspected, put me a couple ahead of him in experience. I was particularly glad to find that all his runs had been rendezvous with space stations. He wouldn't have to learn with me along how to make an approach and bring two objects together in space. He'd done it before.

"The schedule goes something like this," Dick Busch said at the final briefing. They had kept him as the liaison man between orbit, launch and mechanical. After all, it was his hush-hush agency that wanted the facts of the probe.

"Ralph and Mike Seaman go into the heliox tank tonight," Busch said, pulling a mimeographed sheet from his thin dispatch case. "We can't be sure just how soon our Unfriendly Power will fire the boosters on this next probe. We have to be ready if they try to cross us up by an early boost. We'll get the probe on radar at about five diameters, say forty thousand miles. To make interception, we'll have to blast off within fifteen minutes of first radar contact."

"Too close," Ralph Burris said.

Busch looked over at Fred Kupek. "How about it, Fred?" he asked tautly.

Freddy was all shakes and stutters. "I've got the 1401 programmed already," he said hurriedly. "Just as soon as I throw course, location and velocity into the cards, which will take about two minutes after we get a radar fix, I can give you an orbit."

"O.K.," said Busch. "We'll set up a hot wire to the launch pad. They can make gyro settings while we're lifting Ralph and Mike from the heliox tank into the vehicle. We ought to be able to get you buttoned up in fifteen minutes, wouldn't you say?" he asked Burris.

The pilot thought about it. "Can't get suited up in that time," he objected.

"We've got no choice," I said. "We'll live in our suits in the heliox tank."

"For a couple days?" Burris protested.

"Got any better idea? And anyway, I'm betting this probe comes through early. That's what *I'd* do if I wanted to upset an interception."

We suited up at midnight on Friday. The first radar detection was only three hours later. I don't know about Ralph, but I was asleep when the alarm came and they hustled us into our helmets, got the air tanks on our backs and lifted us with a crane the three hundred feet to the top of the four stages.

The framework of the gantry provided a skimpy metal stage for the suited technicians to stand on as they helped Ralph and me into the contour chairs. We'd take off lying on our backs, with our legs a little elevated. The last thing they did was swing the retractable heat shield up in front of the ports—the "windshield" through which Ralph would have to look when he brought us back down in an aircraft-type landing.

One thing about a solid fuel launch, there is only about a tenth as much checking and fiditzeling as when you are being boosted by liquid fuel. Sure, there were pressures and temperatures and gyro speeds and settings, and a hundred other things, and Ralph was quietly saying "Roger" to assorted ground crew men. In the background was a taped voice counting backwards.

"T minus three minutes," it said and fell silent. Then: "T minus two minutes thirty seconds." My belly began to tighten up, and I had that "how the hell did you get in this fix" feeling that I always get before a launch. Ralph was too busy to be anything other than calm. Maybe that's the reason they keep the pilot so busy on countdown, just to keep him from stewing.

"T minus sixty, fifty-nine, fifty-eight," the voice droned, now counting for every second.

"Roger," Ralph said for the hundreth time. That's when somebody kicked us in the back. The big solid-fuel grain came alight all across its surface in a fraction of a second. I could hear the creak of magnesium sheeting as we were instantly in a five-gee lift-off. The pressure on my back quickly increased as the enormous fuel grain burned away, tons every second, lightening the bird so that our acceleration increased until the moment of burnout.

I had blacked out by that time, and I was sure Ralph had, too. Nobody sees anything at twelve-gee.

It was like shifting gears when the second stage cut in. Its rocket grain was smaller than the first stage, but of course the first-stage booster casing had been cast loose, and we had less weight to carry. Still, our acceleration cut back to five-gee again, and vision started to dribble back. It didn't last long, for our weight kept reducing as the second-stage grain eroded with its burning, and our acceleration built up to that murderous twelve-gee.

Second-stage burnout was programmed to be followed by drift while course, velocity and position were tracked on the fine screens. There was chatter on the radio between Ralph and the ground during weightlessness.

"Roger," he said. "Attitude controls activated." He read off a series of angles, and I could feel the ship swing ever so slightly as he made a micrometric change in attitude.

There was another countdown in my ear, a short one, starting at thirty. I could see Ralph, in the dim light of the cabin, reach for a switch. "Firing third stage at zero," he confirmed. The taped voice said "Zero" and we were pulling five-gee again. There was an abrupt shock at the end of the shove, which had never built up to the point where my vision started to go. That meant we had never reached ten-gee, my blind point. The shock was the explosion of charges in the fuel grain to end its burning at the precise second when our velocity was right to make our intersection with the probe we were tracking.

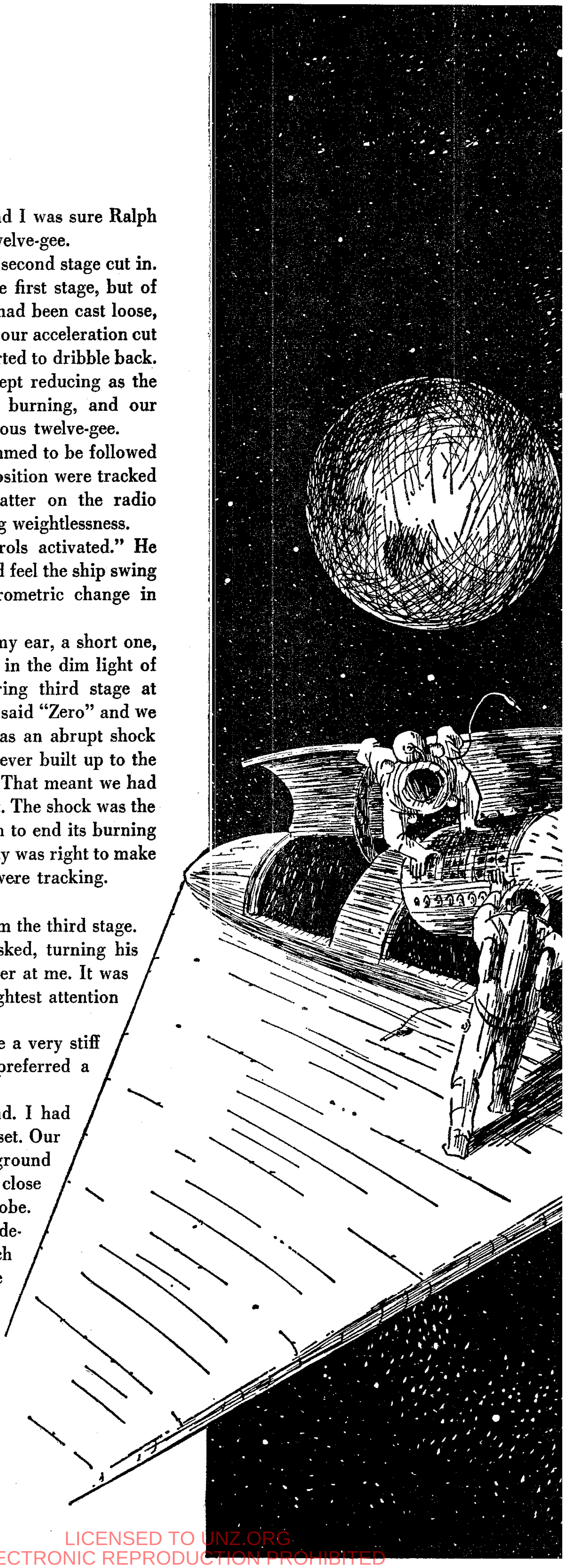
We were in free fall, cast loose from the third stage. "How you riding, Mike?" Ralph asked, turning his head in his bubble helmet to look over at me. It was the first time he had paid me the slightest attention since lift-off.

"I'll live," I grumbled. "But I'll be a very stiff cookie for a few days." I always preferred a liquid-fuel boost.

"Roger," Ralph said to the ground. I had heard the incoming on my own headset. Our insertion into orbit was, as far as the ground was concerned, perfect. Somewhere close to us we should find the hostile probe.

I went into my act, which was to deploy the search radar through its hatch in the top of the control room. There was an immediate pip on the screen. "Got the bandit, Burris," I said, beginning to figure range and vector. It had been a good shoot, the best of the seven I'd ridden.

Now it was Ralph's turn. We



were traveling a mite faster than our target. He tumbled Lambda end over end for a very short burst of retro fire, and then tumbled us again, so we came up on our prey nose first.

One of the things you might forget about being in space is that essentially it is dark. The only thing that is light is something capable of reflecting sunlight. We were, of course, well free of Earth, being then about forty thousand miles out, and were in the full glare of the sun. Our shiny mag wings glistened. Nothing else was visible in space. Only the always incredible powdering of stars was there. The moon was somewhere around, but apparently out of sight behind our bulk. It wasn't near, at any rate.

The probe we were trying to find was straight ahead, the radar said, and not more than ten miles away. Still, when can you see something five or six feet long at a distance of ten miles? It was possibly visible as a reflecting point of light, but indistinguishable in size from the stars that littered the firmament.

"How far?" Burris asked.

"A little under ten miles. We'll be twenty minutes closing up unless you give us a kick in the tail," I warned him.

"We can't afford an extra minute," he said, closing a switch.

We wanted just as little of that hyperbola as possible. The burst lasted several seconds. Then we were working together, doping out the moment of retro fire to stop us cold near the probe. Ralph tumbled our stern sunward, to face the probe, and I got the near-search radar working on the fine range.

"Now!" I said, and the stern tubes gave us several seconds of retro.

"There!" Ralph said, pointing through the nose port.

There was right. We had come close to ramming the probe. We backed slowly past it, or it past us, however you want to figure that sort of thing, not a hundred feet away. Our relative velocities were only a few feet a second. From here on in Ralph had to use the hydrazine and nitric acid steering jets, working us in closely. I started disconnecting the various jacks and plugs that had me connected to the ship. and got my coil of life line clewed up to my side.

"How close do you want me to run in, Mike?" Ralph asked.

I was looking at the probe. As I had said to Busch when I had first seen its photo, it was a real Daddy Long Legs. The long, skinny arms that held its various antennae reached out many feet from what I could now clearly see was a cylinder in its center. Fortunately for us, all the arms were in the same plane, so that we could work our way in close to the central body without hitting one of the antennae.

"Can you bring a wing tip in under that can in the center?" I asked, opening the hatch.

"Like this?" he asked, beginning to work us over with short, soft shoves of the steering jets. We edged closer to the spidery thing that hung there, the wing tip on our dark side drawing under the fringe of skinny arms, and tilting up so that it came closer and closer to the core of the probe.

"Like that," I said. "Can you make contact with the tip?"

"Ram it?" he said, surprised.

"Well, don't knock a hole in it," I said sourly. "I just want you to touch it so our charges are equalized. What do you want me to do, climb out there, reach over and get electrocuted?"

"This will take a little doing," he protested, but the tip of our huge delta wing eased ever so slowly up against the cylinder at the center of the probe—the body in the center of the Daddy Long Legs. The last few seconds seemed to take forever, while the last inches of closure narrowed. There was a sudden very bright flare, a tiny shock to confirm we had made contact, and then a little red glow that faded.

"Wow!" Ralph said softly. "That was one terrific difference in electrical potential. You *would* have been electrocuted. You ever see anything like that before, Mike?"

I hadn't, and it got me thinking. "Listen," I said. "That thing came down from north of the ecliptic. We went out on a course at right angles to that one. We have cut different lines in the magnetic field, and that's why the big difference in charges."

"Maybe," he conceded. "A new phenomenon."

"That's not the only one," I said, observing that we were still in contact with the probe. "Did you notice that red glow where our tip touched the probe?"

"Yes, I did. What was it?"

"It was red-hot magnesium cooling off as heat ran out into the rest of the plating," I said. "Try to roll your tip a few inches away from that probe."

The stars moved slightly across the port. The probe came right along with us.

"I thought so," I said. "We're welded together."

"*What!*"

"That charge equalization was hot enough to spot-weld the probe to our wing tip, Ralph," I said. "We're stuck."

He looked at me in the pale light of the cabin. "If we can't shake that thing loose, Mike," he said quietly, "we can't even abort the mission."

I could see his point. With that weight stuck way out on our wing tip, our combined center of gravity was no longer lined up with our rockets. If Ralph pressed the firing key, we'd just spin like a giant Catherine wheel. Our retro fire wouldn't work.

"Let's not holler till we know we're hurt," I suggested. But I was feeling a little sick. "The spot-weld may only be a tiny thing. Try twisting us free—roll us with the steering jets."

"I did that," Ralph reminded me. "That ugly thing came right along with us."

"You only applied a couple pounds of torque," I said. "Roll us more sharply."

"And tear off the wing sheeting? We'd burn up on re-entry if there was a ragged edge out there."

"Well, twitch it a little. Do you have enough rolling moment in the jets to really damage the skin?"

"I don't know," he said. "I'll try it."

The stars moved again, more quickly this time. So did the probe. We were still stuck.

I moved out of my seat with care, now that the hatch was open over my head. No point to go sailing out of our ship. "Let me take a look at it," I said. "I've got cutting tools, you know. We'll work out something."

"Don't take all night," Ralph said. "We only have two hours before we reach the limit of our retro fire."

"Sure," I said.

They had provided a series of loops for hand holds along the upper and lower wing surfaces. They were there to help me clamber around out in space and to use in clewing up lines if I had to tie anything down while I worked on it. They were made of an ablative material that would abrade away from air-friction on re-entry. Right now they were darned handy.

I was out of the ship now, taking care to work my way from hand hold to hand hold. There'd be no tragedy if I lost my grip, for I had tiny hypergolic rockets on my back and my belly to move me around in free fall. I locked my heated life line into the jack provided in the side of the hull, checked to make sure it was drawing current, so that it wouldn't chill and get brittle, and took stock.

Our vehicle was exactly between the Sun and the Earth, for we had matched the probe's hyperbola, carrying it straight to the Sun. In that position the Earth, about eight diameters away, was an enormous full moon, subtending an angle of ten or twelve degrees. The continents and storm systems were clearly visible. The Sun, of course, still had its normal size as seen from Earth, but it was ardently brilliant, making the big moon of Earth, insignificant in terms of the amount of light it supplied. One thing was sure, I'd have enough illumination for the work, what with light coming from both sides.

Dragging the life line behind me, I worked my way forty feet out to the wing tip. I had to scrooch down a little to slide under one of the probe's antennae that hung parallel to the upper surface of our delta wing.

"How does it look?" the earphone said, with Ralph's voice still calm.

"Tough," I said as I got up close. "It's not an edge joint. Two plane surfaces are welded together. I can't get in there with my saw."

I hadn't bothered to carry my tools the first trip out—I wanted to assess the problem. They had provided me with a circular saw, powered by an air turbine that ran off the heliox tanks on my back, and swinging a diamond-tipped blade. That was to use in cutting the antennae free so that we would be able to stuff the central body of the probe into our hold. If possible, we had decided, we'd fold the antennae up as much as possible and stuff as much of them in as would fit. They had been shot into space all folded up, and had opened like an insect's wing as it comes out of its cocoon once the final booster had fired and sent the probe into hyperbola.

"What next?" Ralph said. "Can you cut up the main body of the probe until you get down to where the skin of that thing is welded to our tip?"

"Saw blade wouldn't last that long, even if my heliox did," I protested. "I need a welding torch."

"It's a sixty-thousand mile walk to get one," Ralph said.

"I wonder." I took a good look at the probe we were stuck to. Its antennae were of two kinds. As I had seen in the coarse-grained photo Busch had shown me a week before, there were cup-shaped detectors of some kind. But the other half were square, flat, and quite sizable, about three yards on a side. I worked my way back toward the fuselage of our bird so that I could grip one of the skinny antenna arms and examine one of the squares more closely.

"We may have a chance," I said. "This thing is powered by solar batteries, and it's got half an acre of them."

"What of it?" Ralph asked.

"They are electrical power, Ralph. Maybe I can hook them up in parallel and get enough amperage to have an arc-welder. I'll cut the thing up and get us loose."

His breath hissed in his microphone. "In two hours?" he protested. "It'll take you a day just to figure out the wiring."

"Looks simpler than that. Bring the tools out," I said.

The probe had eight of those skinny arms, which had accentuated its resemblance to a Daddy Long Legs. Four of the arms ended in solar batteries. We went to work, cutting them off close to the central body.

"I can't use this yet," I warned Ralph, as he handed me the saw. "I want to cut the leads, and I'll hit a hot wire, sure as the devil. Can't risk damaging the saw blade that way. Where are the insulated cutters?"

He detached what was essentially a rubber-sheathed magnesium bolt-cutter with steel jaws from his belt, and handed it to me. The current from the solar batteries wasn't overpowering, but it was enough to put a nick in the blade as I snapped the lead from them to the central body of the probe. There were four hot cuts to make, and I pretty well ruined the cutter. At least I didn't ground myself in the process, and got no jolts of current.

The saw whirred smoothly in my hand as I triggered the valve that bled air from my tanks to its high-speed turbine. The geared-down diamond-tip wheel made quick work of cutting the actual antenna arm. We tied the first one down to a couple hand holds and worked our way around to the next one.

In about twenty minutes we had the four solar batteries loose, and I was testing the current they were putting out. I was half afraid they had been wired up in series to give high voltage current, but the hostile power had better engineers than that. No point piping high-tension stuff around when you can carry the easier-to-handle lower voltages and boost it up inside the central body.

I was no welder, but I remembered that about forty-five volts was right, and the more amperage the better. I began to pray that the solar batteries were of a high order of efficiency. There were about thirty-six square meters of surface, which in theory meant about thirty-six kilowatts at a hundred per cent efficiency. Solar batteries came in all kinds, the best of them putting about forty per cent of their theoretical power. That would have given me about fifteen kilowatts, and at forty-five volts the amperage might be enough.

Still, for welding tips I had absolutely nothing. I worked my way back into the ship and started looking around for some kind of rod, something a little more durable than the silver cable that ran from the solar batteries to the central body. There were two light brace rods used to hold the cargo hatch open, and I cannibalized them with the bolt cutter.

Ralph was busy lining the solar batteries up so that they faced the Sun squarely, while I wired them up. They were hot—we had no switch—and I had to be careful that one lead was always hanging free in space when I worked on the other side of the circuit.

"Hurry," Ralph said. "Our first hour is gone. That's half our time."

"Needle me," I snapped. "It will make me more sure-fingered!"

"I'm sorry," he said. "How can I help?"

"Hold this lead from touching the ship," I said. "When the time comes, touch it down to our leading edge. It should weld fast, and that will be our ground line. I'll use the other lead for the cutting arc."

It was harder than it sounded. The amount of current we were getting from the batteries was hardly equal to the job. Whenever I touched my lead to the probe. I'd just get local heating, not melting, unless I touched it where the skin was very thin. But there was surge voltage when I broke the contact, and at each surge a little spot melted and some of it vaporized.

We couldn't have too much vaporization, or the condensing metal would cloud up our helmets. I used a pry bar to tear at the red-hot metal, shredding the sheeting around the probe away as I heated it. Your mind has a nice kind of a clock in it, and I could see that the timing was going to be close.

"Ralph," I said into my mike.

"Roger," he acknowledged automatically.

"Take the saw and cut the rest of the antennae loose and see if you can fold them up. If I get this thing cut free, maybe we can complete the mission."

He started to tell me the hell with the mission, but doing something was better than watching me chip away at the skin of the probe.

I had to tear it pretty well open to get to where the two skins had welded together. When the probe's skin was about half off, I could see electronic components wired inside. Using a small snips, I cut away what looked like a condenser or resistor, and put it in the pouch at my belt.

Finally I was working at the two skins, and suddenly the probe had a small proper motion. I gave its mass a shove and, Glory be, it moved away from the wing tip.

"Got it free, Ralph," I said. "Come on over here. This thing has plenty of mass, even if it doesn't weigh anything. Help me man-handle it to the hatch."

When Ralph had finished cutting the remainder of the antennae loose, he had gotten the cargo hatch open and taken out the tanks of polyurethane gook we had stored in there. They were hanging limply at the end of lines, out of the way, but ready for use. The central body of the probe was a heavy dog. It's hard to judge weights in free fall, but I had an idea it weighed close to five hundred pounds. Our seven-foot fuselage had a hatch five feet by seven, and it was a pretty tight fit to get the probe inside. We had to hack up the antennae to get them in, and I junked all but a small part of the solar batteries. A sample would be enough to study.

Ralph held the central body of the probe pretty well centered in the hold while I got the foam nozzles ready. Starting "underneath" the thing we were taking home, I squirted the hold full of the foam. It expanded rapidly in the vacuum of space. But the engineers had doped it out well, and bubble size remained small enough to give us the mechanical strength we would need to cushion the probe on re-entry. I worked more carefully as I "topped off" the hold, so that the hatch would close as smoothly as possible over the foam. Ralph seated the hatch and we worked our way back into our contour chairs.

"How's the time?" I asked, plugging jacks into the central heliox supply and the intercom.

"Ten minutes leeway," he said. "Based on a probe weight of seven hundred and fifty pounds. How about it?"

"In like Flynn," I said. "Give that foam five minutes to set up solid, and start flying, fly-boy."

Our stern rockets could kick up some respectable acceleration when they were all fired at once. Ralph gave us a sharp kick in the pants for about twenty seconds and then got on the radio. There was a lot of chatter about course, position and velocity, and then we went through the bit of conning the ship around to a new angle for the rest of the retro-fire. "I'll have to use it all," Ralph said. "That means a dead-stick landing. We'll have to be right the first time!"

I turned on the cabin light as we drifted, our rocket thrust completely spent, headed for a "bounce" approach to Earth. "Look here," I said, taking the thing I had snipped from the probe out of my belt pouch. Ralph took it carefully in his gloved fingers. It was pretty small to handle in a spacesuit.

"What is it?" he asked.

"Condenser. Made in Hong Kong."

I could see him frown in his helmet. "What's the significance?"

"Just data—a help in making an educated guess," I said. "I recognize the thing from samples I saw at COMCORP. The Chinese import a lot of stuff from Hong Kong. I'm betting our Hostile Power is China."

"Just in case," Ralph said, switching on the radio. "Let's report."

"In code, please," I reminded him. "We are surely being monitored. In all likelihood that probe had an encounter-detector on board and reported back to China that an intercept had been made. Why let them know what we found out?"

"Good gravy!" Ralph said. "I just thought of something!"

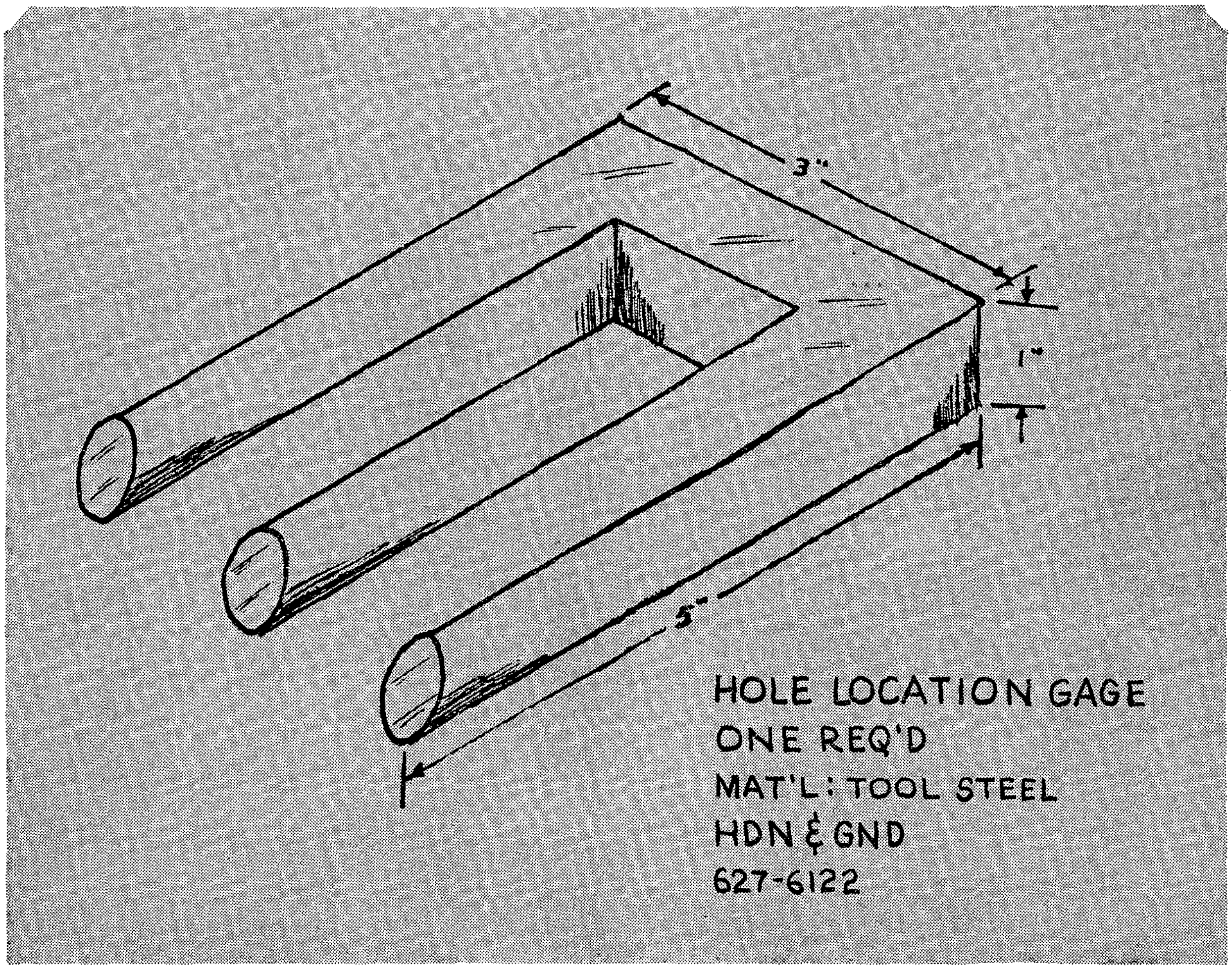
"What?"

"That Hostile Power—say it was China—must have known that an intercept was a possibility, no matter how remote. They could guess that we haven't revealed the full capabilities of our hardware!"

"Of course," I said, putting the condenser back in my pouch. "What of it?"

"What if they had booby-trapped that thing?"

"I thought you'd wise up after a while," I said. "What do you think I was so afraid of, just riding around in space! That's old hat!" ■



This outrageous piece of draftsmanship evidently escaped from the Finagle & Diddle Engineering works. If the contributor of this item—sent anonymously for some reason—will identify himself, we will happily pay $10 (ten bucks) or a two-year subscription to ANALOG. The Editor

DOLPHIN'S WAY

In the last few years, massive efforts have been made in an effort to establish communication with what we now have reason to believe is Earth's other intelligent race—the Dolphin. But perhaps Man's efforts aren't the first . . .

Gordon Dickson

Illustrated by Leo Summers

Of course, there was no reason why a woman coming to Dolphin's Way—as the late Dr. Edwin Knight had named the island research station—should not be beautiful. But Mal had never expected such a thing to happen.

Castor and Pollux had not come to the station pool this morning. They might have left the station, as other wild dolphins had in the past—and Mal nowadays carried always with him the fear that the Willernie Foundation would seize on some excuse to cut off their funds for further research. Ever since Corwin Brayt had taken over, Mal had known this fear. Though Brayt had said nothing. It was only a feeling Mal got from the presence of the tall, cold man. So it was that Mal was out in front of the station, scanning the ocean when the water-taxi from the mainland brought the visitor.

She stepped out on the dock, as he stared down at her. She waved as if she knew him, and then climbed the stairs from the dock to the terrace in front of the door to the main building of the station.

"Hello," she said, smiling as she stopped in front of him. "You're Corwin Brayt?"

Mal was suddenly sharply conscious of his own lean and ordinary appearance in contrast to her startling beauty. She was brown-haired and tall for a girl—but these things did not describe her. There was a perfection to her—and her smile stirred him strangely.

"No," he said. "I'm Malcolm Sinclair. Corwin's inside."

"I'm Jane Wilson," she said. "*Background Monthly* sent me out to do a story on the dolphins. Do you work with them?"

"Yes," Mal said. "I started with Dr. Knight in the beginning."

"Oh, good," she said. "Then, you can tell me some things. You were here when Dr. Brayt took charge after Dr. Knight's death?"

"Mr. Brayt," he corrected automatically. "Yes." The emotion she moved in him was so deep and strong it seemed she must feel it too. But she gave no sign.

"Mr. Brayt?" she echoed. "Oh. How did the staff take to him?"

"Well," said Mal, wishing she would smile again, "everyone took to him."

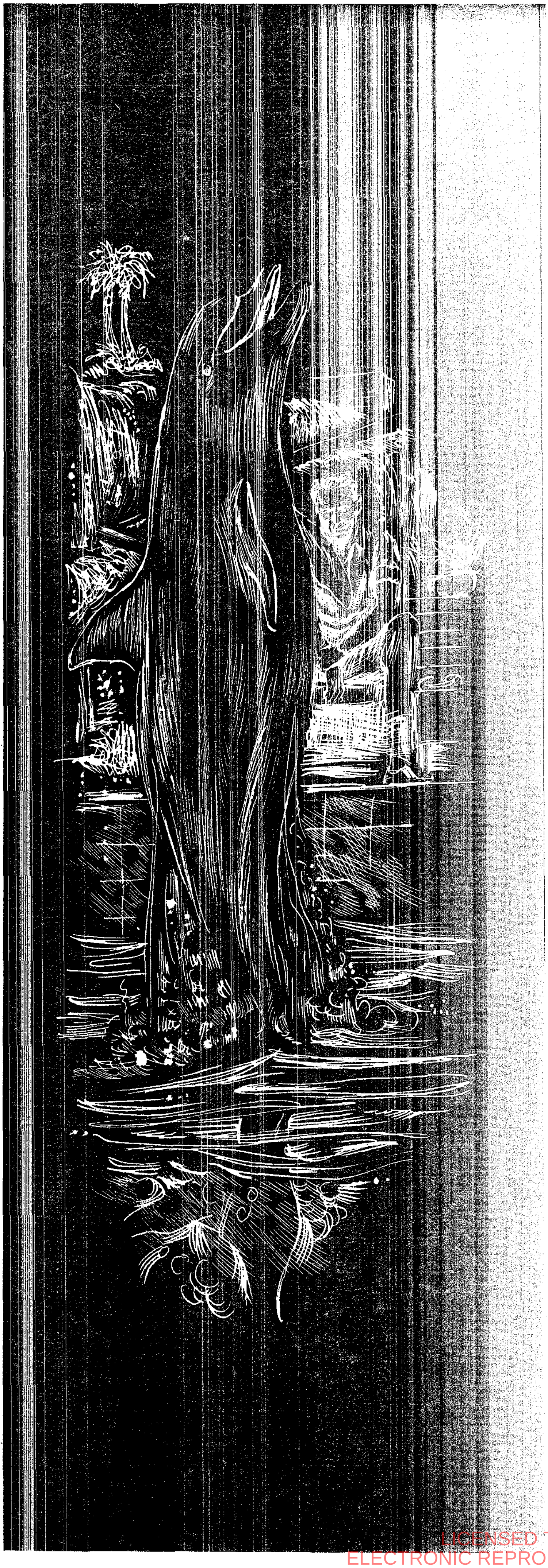
"I see," she said. "He's a good research head?"

"A good administrator," said Mal. "He's not involved in the research end."

"He's not?" She stared at him. "But didn't he replace Dr. Knight, after Dr. Knight's death?"

"Why, yes," said Mal. He made an effort to bring his attention back to the conversation. He had never had a woman affect him like this before. "But just as administrator of the station, here. You see—most of our funds for work here come from the Willernie Foundation. They had faith in Dr. Knight, but when he died . . . well, they wanted someone of their own in charge. None of us mind."

"Willernie Foundation," she said. "I don't know it."



"It was set up by a man named Willernie, in St. Louis, Missouri," said Mal. "He made his money manufacturing kitchen utensils. When he died he left a trust and set up the Foundation to encourage basic research." Mal smiled. "Don't ask me how he got from kitchen utensils to that. That's not much information for you, is it?"

"It's more than I had a minute ago," she smiled back. "Did you know Corwin Brayt before he came here?"

"No." Mal shook his head. "I don't know many people outside the biological and zoological fields."

"I imagine you know him pretty well now, though, after the six months he's been in charge."

"Well—" Mal hesitated, "I wouldn't say I know him *well,* at all. You see, he's up here in the office all day long and I'm down with Pollux and Castor—the two wild dolphins we've got coming to the station, now. Corwin and I don't see each other much."

"On this small island?"

"I suppose it seems funny—but we're both pretty busy."

"I guess you would be," she smiled again. "Will you take me to him?"

"Him?" Mal awoke suddenly to the fact they were still standing on the terrace. "Oh, yes—it's Corwin you came to see."

"Not just Corwin," she said. "I came to see the whole place."

"Well, I'll take you in to the office. Come along."

He led her across the terrace and in through the front door into the air-conditioned coolness of the interior. Corwin Brayt ran the air-conditioning constantly, as if his own somewhat icy personality demanded the dry, distant coldness of a mountain atmosphere. Mal led Jane Wilson down a short corridor and through another door into a large wide-windowed office. A tall, slim, broad-shouldered man with black hair and a brown, coldly handsome face looked up from a large desk, and got to his feet on seeing Jane.

"Corwin," said Mal. "This is Miss Jane Wilson from *Background Monthly.*"

"Yes," said Corwin expressionlessly to Jane, coming around the desk to them. "I got a wire yesterday you were coming." He did not wait for Jane to offer her hand, but offered his own. Their fingers met.

"I've got to be getting down to Castor and Pollux," said Mal, turning away.

"I'll see you later then," Jane said, looking over at him.

"Why, yes. Maybe—" he said. He went out. As he closed the door of Brayt's office behind him, he paused for a moment in the dim, cool hallway, and shut his eyes. *Don't be a fool,* he told himself, *a girl like that can do a lot better than someone like you. And probably has already.*

He opened his eyes and went back down to the pool behind the station and non-human world of the dolphins.

When he got there, he found that Castor and Pollux were back. Their pool was an open one, with egress to the open blue waters of the Caribbean. In the first days of the research at Dolphin's Way, the dolphins had been confined in a closed pool like any captured wild animal. It was only later on, when the work at the station had come up against what Knight had called "the environmental barrier" that the notion was conceived of opening the pool to the sea, so that the dolphins they had been working with could leave or stay, as they wished.

They had left—but they had come back. Eventually, they had left for good. But strangely, wild dolphins had come from time to time to take their place, so that there were always dolphins at the station.

Castor and Pollux were the latest pair. They had showed up some four months ago after a single dolphin frequenting the station had disappeared. Free, independent—they had been most co-operative. But the barrier had not been breached.

Now, they were sliding back and forth past each other underwater utilizing the full thirty-yard length of the pool, passing beside, over and under each other, their seven-foot nearly identical bodies almost, but not quite, rubbing as they passed. The tape showed them to be talking together up in the supersonic range, eighty to a hundred and twenty kilocycles per second. Their pattern of movement in the water now was something he had never seen before. It was regular and ritualistic as a dance

He sat down and put on the earphones connected to the hydrophones, underwater at each end of the pool. He spoke into the microphone, asking them about their movements, but they ignored him and kept on with the patterned swimming.

The sound of footsteps behind him made him turn. He saw Jane Wilson approaching down the concrete steps from the back door of the station, with the stocky, overalled, figure of Pete Adant, the station mechanic.

"Here he is, " said Pete, as they came up. "I've got to get back, now."

"Thank you." She gave Pete the smile that had so moved Mal earlier. Pete turned and went back up the steps. She turned to Mal. "Am I interrupting something?"

"No." He took off the earphones. "I wasn't getting any answers, anyway."

She looked at the two dolphins in their underwater dance with the liquid surface swirling above them as they turned now this way, now that, just under it.

"Answers?" she said. He smiled a little ruefully.

"We call them answers," he said. He nodded at the two smoothly streamlined shapes turning in the pool. "Sometimes we can ask questions and get responses."

"Informative responses?" she asked.

"Sometimes. You wanted to see me about something?"

"About everything," she said. "It seems you're the man I came to talk to—not Brayt. He sent me down here. I understand you're the one with the theory."

"Theory?" he said warily, feeling his heart sink inside him.

"The notion, then," she said. "The idea that, if there is some sort of interstellar civilization, it might be waiting for the people of Earth to qualify themselves before making contact. And that test might not be a technological one like developing a faster-than-light means of travel, but a sociological one—"

"Like learning to communicate with an alien culture—a culture like that of the dolphins," he interrupted harshly. "Corwin told you this?"

"I'd heard about it before I came," she said. "I'd thought it was Brayt's theory, though."

"No," said Mal, "it's mine." He looked at her. "You aren't laughing."

"Should I laugh?" she said. She was attentively watching the dolphins' movements. Suddenly he felt sharp jealousy of them for holding her attention; and the emotion pricked him to something he might not otherwise have had the courage to do.

"Fly over to the mainland with me," he said, "and have lunch. I'll tell you all about it."

"All right." She looked up from the dolphins at him at last and he was surprised to see her frowning. "There's a lot I don't understand," she murmured. "I thought it was Brayt I had to learn about. But it's you—and the dolphins."

"Maybe we can clear that up at lunch, too," Mal said, not quite clear what she meant, but not greatly caring, either. "Come on, the helicopters are around the north side of the building."

They flew a copter across to Carúpano, and sat down to lunch looking out at the shipping in the open roadstead of the azure sea before the town, while the polite Spanish of Venezuelan voices sounded from the tables around them.

"Why should I laugh at your theory?" she said again, when they were settled, and eating lunch.

"Most people take it to be a crackpot excuse for our failure at the station," he said.

Her brown arched brows rose. "Failure?" she said. "I thought you were making steady progress."

"Yes. And no," he said. "Even before Dr. Knight died, we ran into something he called the environmental barrier."

"Environmental barrier?"

"Yes." Mal poked with his fork at the shrimp in his seafood cocktail. "This work of ours all grew out of the work done by Dr. John Lilly. You read his book, *'Man and Dolphin'?*"

"No," she said. He looked at her, surprised.

"He was the pioneer in this research with dolphins," Mal said. "I'd have thought reading his book would have been the first thing you would have done before coming down here."

"The first thing I did," she said, "was try to find out something about Corwin Brayt. And I was pretty unsuccessful at that. That's why I landed here with the notion that it was he, not you, who was the real worker with the dolphins."

"That's why you asked me if I knew much about him?"

"That's right," she answered. "But tell me about this environmental barrier."

"There's not a great deal to tell," he said. "Like most big problems, it's simple enough to state. At first, in working with the dolphins, it seemed the early researchers were going great guns, and communication was just around the corner—a matter of interpreting the sounds they made to each other, in the humanly audible range, and above it; and teaching the dolphins human speech."

"It turned out those things couldn't be done?"

"They could. They were done—or as nearly so as makes no difference. But then we came up against the fact that communication doesn't mean understanding." He looked at her. "You and I talk the same language, but do we really understand perfectly what the other person means when he speaks to us?"

She looked at him for a moment, and then slowly shook her head without taking her eyes off his face.

"Well," said Mal, "that's essentially our problem with the dolphins—only on a much larger scale. Dolphins, like Castor and Pollux, can talk with me, and I with them, but we can't understand each other to any great degree."

"You mean intellectually understood, don't you?" Jane said. "Not just mechanically?"

"That's right," Mal answered. "We agree on denotation of an auditory or other symbol, but not on connotation. I can say to Castor—'*the Gulf Stream is a strong ocean current*' and he'll agree exactly. But neither of us really has the slightest idea of what the other really means. My mental image of the Gulf Stream is not Castor's image. My notion of 'powerful' is relative to the fact I'm six feet tall, weigh a hundred and seventy-five pounds and can lift my own weight against the force of gravity. Castor's is relative to the fact that he is seven feet long, can speed up to forty miles an hour through the water, and as far as he knows weighs nothing, since his four hundred pounds of body-weight are balanced out by the equal weight of the water he displaces. And the concept of lifting something is all but unknown to him. My mental abstraction of 'ocean' is not his, and our ideas of what a current is may coincide, or be literally worlds apart in meaning. And so far we've found no way of bridging the gap between us."

'The dolphins have been trying as well as you?"

"I believe so," said Mal. "But I can't prove it. Any more than I can really prove the dolphin's intelligence to hard-core skeptics until I can come up with something previously outside human knowledge that the dolphins have taught me. Or have them demonstrate that they've learned the use of some human intellectual process. And in these things we've all failed—because, as I believe and Dr. Knight believed, of the connotative gap, which is a result of the environmental barrier."

She sat watching him. He was probably a fool to tell her all this, but he had had no one to talk to like this since Dr. Knight's heart attack, eight months before, and he felt words threatening to pour out of him.

"We've got to learn to think like the dolphins," he said, "or the dolphins have to learn to think like us. For nearly six years now we've been trying and neither side's succeeded." Almost before he thought, he added the one thing he had been determined to keep to himself. "I've been afraid our research funds will be cut off any day now."

"Cut off? By the Willernie Foundation?" she said. "Why would they do that?"

"Because we haven't made any progress for so long," Mal said bitterly. "Or, at least, no provable progress. I'm afraid time's just about run out. And if it runs out, it may never be picked up again. Six years ago, there was a lot of popular interest in the dolphins. Now, they've been discounted and forgotten, shelved as merely bright animals."

"You can't be sure the research won't be picked up again."

"But I feel it," he said. "It's part of my notion about the ability to communicate with an alien race being the test for us humans. I feel we've got this one chance and if we flub it, we'll never have another." He pounded the table softly with his fist. "The worst of it is, I *know* the dolphins are trying just as hard to get through from their side—if I could only recognize what they're doing, how they're trying to make me understand!"

Jane had been sitting watching him.

"You seem pretty sure of that," she said. "What makes you so sure?"

He unclenched his fist and forced himself to sit back in his chair.

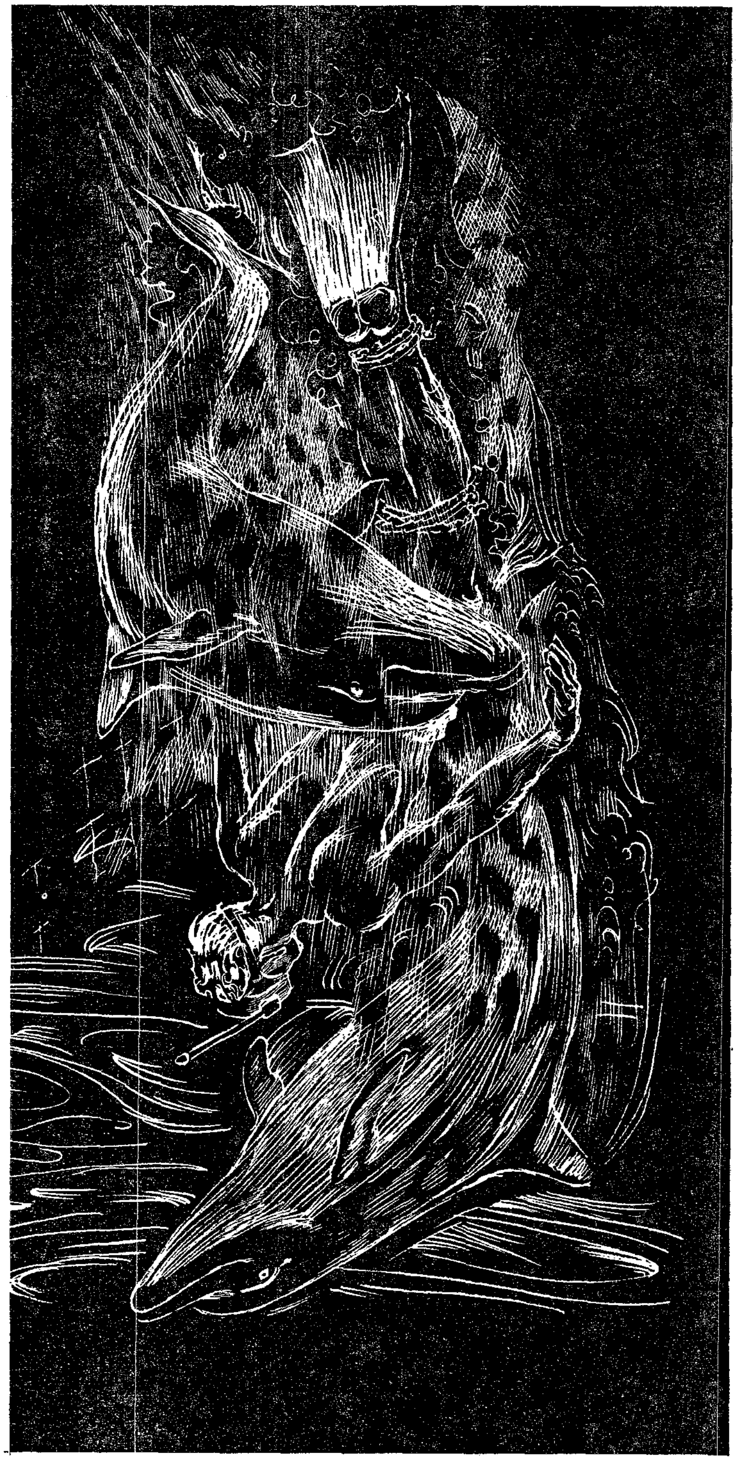
"Have you ever looked into the jaws of a dolphin?" he said. "They're this long." He spread his hands apart in the air to illustrate. "And each pair of jaws contains eighty-eight sharp teeth. Moreover, a dolphin like Castor weighs several hundred pounds and can move at water speeds that are almost incredible to a human. He could crush you easily by ramming you against the side of a tank, if he didn't want to tear you apart with his teeth, or break your bones with blows of his flukes." He looked at her grimly. "In spite of all this, in spite of the fact that men have caught and killed dolphins—even we killed them in our early, fumbling researches, and dolphins are quite capable of using their teeth and strength on marine enemies—no dolphin has ever been known to attack a human being. Aristotle, writing in the Fourth Century B.C., speaks of the quote gentle and kindly end quote nature of the dolphin."

He stopped, and looked at Jane sharply.

"You don't believe me," he said.

"Yes," she said. "Yes, I do." He took a deep breath.

"I'm sorry," he said. "I've made the mistake of mentioning all this before to other people and been sorry I



did. I told this to one man who gave me his opinion that it indicated that the dolphin instinctively recognized human superiority and the value of human life." Mal grinned at her, harshly. "But it was just an instinct. *'Like dogs,'* he said. *'Dogs instinctively admire and love people—'* and he wanted to tell me about a dachshund he'd had, named Poochie, who could read the morning newspaper and wouldn't bring it in to him if there was a tragedy reported on the front page. He could prove this, and Poochie's intelligence, by the number of times he'd had to get the paper off the front step himself."

Jane laughed. It was a low, happy laugh; and it took the bitterness suddenly out of Mal.

"Anyway," said Mal, "the dolphin's restraint with humans is just one of the indications like the wild dolphins coming to us here at the station, that've convinced me the dolphins are trying to understand us, too. And have been, maybe, for centuries."

"I don't see why you worry about the research stopping," she said. "With all you know, can't you convince people—"

"There's only one person I've got to convince," said Mal. "And that's Corwin Brayt. And I don't think I'm doing it. It's just a feeling—but I feel as if he's sitting in judgment upon me, and the work. I feel . . ." Mal hesitated, "almost as if he's a hatchet man."

"He isn't," Jane said. "He can't be. I'll find out for you, if you like. There're ways of doing it. I'd have the answer for you right now, if I'd thought of him as an administrator. But I thought of him as a scientist, and I looked him up in the wrong places."

Mal frowned at her, unbelievingly.

"You don't actually mean you can find out that for me?" he asked.

She smiled.

"Wait and see," she replied. "I'd like to know, myself, what his background is."

"It could be important," he said, eagerly. "I know it sounds fantastic—but if I'm right, the research with the dolphins could be important, more important than anything else in the world."

She stood up suddenly from the table.

"I'll go and start checking up right now," she said. "Why don't you go on back to the island? It'll take me a few hours and I'll take the water-taxi over."

"But you haven't finished lunch, yet," he said. "In fact you haven't even started lunch. Let's eat first, then you can go."

"I want to call some people and catch them while they're still at work," she said. "It's the time difference on these long-distance calls. I'm sorry. We'll have dinner together, tonight—will that do?"

"It'll have to," he said. She melted his disappointment with one of her amazing smiles, and went.

With her gone, Mal found he was not hungry himself. He got hold of the waiter and managed to cancel the main course of their meals. He sat and had two more drinks—not something usual for him. Then he left and flew the copter back to the island.

Pete Adant encountered him as he was on his way from the copter park to the dolphin pool.

"There you are," said Pete. "Corwin wants to see you in an hour—when he gets back, that is. He's gone over to the mainland himself."

Ordinarily, such a piece of news would have awakened the foreboding about cancellation of the research that rode always like a small, cold, metal weight inside Mal. But the total of three drinks and no lunch had anesthetized him somewhat. He nodded and went on to the pool.

The dolphins were still there, still at their patterned swimming. Or was he just imagining the pattern? Mal sat down on his chair by the poolside before the tape recorder which set down a visual pattern of the sounds made by the dolphins. He put the earphones to the hydrophones on, switching on the mike before him.

Suddenly, it struck him how futile all this was. He had gone through these same motions daily for four years now. And what was the sum total of results he had to show for it? Reel on reel of tape recording a failure to hold any truly productive conversation with the dolphins.

He took the earphones off and laid them aside. He lit a cigarette and sat gazing with half-seeing eyes at the underwater ballet of the dolphins. To call it ballet was almost to libel their actions. The gracefulness, the purposefulness of their movements, buoyed up by the salt water, was beyond that of any human in air or on land. He thought again of what he had told Jane Wilson about the dolphin's refusal to attack their human captors, even when the humans hurt or killed them. He thought of the now-established fact that dolphins will come to the rescue of one of their own who has been hurt or knocked unconscious, and hold him up on top of the water so he would not drown—the dolphin's breathing process requiring conscious control, so that it failed if the dolphin became unconscious.

He thought of their playfulness, their affection, the wide and complex range of their speech. In any of those categories, the average human stacked up beside them looked pretty poor. In the dolphin culture there was no visible impulse to war, to murder, to hatred and unkindness. No wonder, thought Mal, they and we have trouble understanding each other. In a different environment, under different conditions, they're the kind of people we've always struggled to be. We have the technology, the tool-using capability, but with it all in many ways we're more animal than they are.

Who's to judge which of us is better, he thought, looking at their movements through the water with the slight hazy melancholy induced by the three drinks on an empty stomach. I might be happier myself, if I were a dolphin. For a second, the idea seemed deeply attractive. The endless open sea, the freedom, an end to all the complex structure of human culture on land. A few lines of poetry came back to him.

"Come, Children," he quoted out loud to himself, *"let us away! Down and away, below . . . !"*

He saw the two dolphins pause in their underwater ballet and saw that the microphone before him was on. Their heads turned toward the microphone underwater at the near end of the pool. He remembered the following lines, and he quoted them aloud to the dolphins.

". . . Now my brothers call from the bay,
"Now the great winds shoreward blow,
"Now the salt tides seaward flow;
"Now the wild white horses play,
*"Champ and chafe and toss in the spray—"**

He broke off suddenly, feeling self-conscious. He looked down at the dolphins. For a moment they merely hung where they were under the surface, facing the microphone. Then Castor turned and surfaced. His forehead with its blowhole broke out into the air and then his head as he looked up at Mal. His air-borne voice from the blowhole's sensitive lips and muscles spoke quacking words at the human.

"Come, Mal," he quacked, *"Let us away! Down and away! Below!"*

The head of Pollux surfaced beside Castor's. Mal stared at them for a long second. Then he jerked his gaze back to the tape of the recorder. There on it, was the rhythmic record of his own voice as it had sounded in the pool, and below it on their separate tracks, the tapes showed parallel, rhythyms coming from the dolphins. They had been matching his speech largely in the inaudible range while he was quoting.

**"The Forsaken Merman,"* by Mathew Arnold, 1849.

Still staring, Mal got to his feet, his mind trembling with a suspicion so great he hesitated to put it into words. Like a man in a daze he walked to the near end of the pool, where three steps led down into the shallower part. Here the water was only three feet deep.

"Come, Mal!" quacked Castor, as the two still hung in the water with their heads out, facing him. *"Let us away! Down and away! Below!"*

Step by step, Mal went down into the pool. He felt the coolness of the water wetting his pants legs, rising to his waist as he stood at last on the pool floor. A few feet in front of him, the two dolphins hung in the water, facing him, waiting. Standing with the water rippling lightly above his belt buckle, Mal looked at them, waiting for some sign, some signal of what they wanted him to do.

They gave him no clue. They only waited. It was up to him to go forward on his own. He sloshed forward into deeper water, put his head down, held his breath and pushed himself off underwater.

In the forefront of his blurred vision, he saw the grainy concrete floor of the pool. He glided slowly over it, rising a little, and suddenly the two dolphins were all about him—gliding over, above, around his own underwater floating body, brushing lightly against him as they passed, making him a part of their underwater dance. He heard the creaking that was one of the underwater sounds they made and knew that they were probably talking in ranges he could not hear. He could not know what they were saying, he could not sense the meaning of their movements about him, but the feeling that they were trying to convey information to him was inescapable.

He began to feel the need to breathe. He held out as long as he could, then let himself rise to the surface. He broke water and gulped air, and the two dolphin heads popped up nearby, watching him. He dove under the surface again. *I am a dolphin*—he told himself almost desperately —*I am not a man, but a dolphin, and to me all this means —what?*

Several times he dove, and each time the persistent and disciplined movements of the dolphins about him underwater convinced him more strongly that he was on the right track. He came up, blowing, at last. He was not carrying the attempt to be like them far enough, he thought. He turned and swam back to the steps at the shallow end of the pool, and began to climb out.

"Come, Mal—let us away!" quacked a dolphin voice behind him, and he turned to see the heads of both Castor and Pollux out of the water, regarding him with mouths open urgently.

"Come, Children—down and away!" he repeated, as reassuringly as he could intonate the words.

He hurried up to the big cabinet of the supply locker at the near end of the pool, and opened the door of the section on skin-diving equipment. He needed to make himself more like a dolphin. He considered the air tanks and the mask of the scuba equipment, and rejected them. The dolphins could not breathe underwater any more than he could. He started jerking things out of the cabinet.

A minute or so later he returned to the steps in swimming trunks, wearing a glass mask with a snorkel tube, and swim fins on his feet. In his hand he carried two lengths of soft rope. He sat down on the steps and with the rope tied his knees and ankles together. Then, clumsily, he hopped and splashed into the water.

Lying face down in the pool, staring at the bottom through his glass faceplate, he tried to move his bound legs together like the flukes of a dolphin, to drive himself slantingly down under the surface.

After a moment or two he managed it. In a moment the dolphins were all about him as he tried to swim underwater, dolphinwise. After a little while his air ran short again and he had to surface. But he came up like a dolphin and lay on the surface filling his lungs, before fanning himself down fluke-fashion with his swim fins. *Think like a dolphin,* he kept repeating to himself over and over. *I am a dolphin. And this is my world. This is the way it is.*

. . . And Castor and Pollux were all about him.

The sun was setting in the far distance of the ocean when at last he dragged himself, exhausted, up the steps of the pool and sat down on the poolside. To his water-soaked body, the twilight breeze felt icy. He unbound his legs, took off his fins and mask and walked wearily to the cabinet. From the nearest compartment he took a towel and dried himself, then put on an old bathrobe he kept hanging there. He sat down in an aluminum deckchair beside the cabinet and sighed with weariness.

He looked out at the red sun dipping its lower edge in the sea, and felt a great warm sensation of achievement inside him. In the darkening pool, the two dolphins still swam back and forth. He watched the sun descending . . .

"Mal!"

The sound of Corwin Brayt's voice brought his head around. When he saw the tall, cold-faced man was coming toward him with the slim figure of Jane alongside, Mal got up quickly from his chair. They came up to him.

"Why didn't you come in to see me as I asked?" Brayt said. "I left word for you with Pete. I didn't even know you were back from the mainland until the water-taxi brought Miss Wilson out just now, and she told me."

"I'm sorry," said Mal. "I think I've run into something here—"

"Never mind telling me now." Brayt's voice was hurried and sharpened with annoyance. "I had a good deal to speak to you about but there's not time now if I'm to catch the mainland plane to St. Louis. I'm sorry to break it this way—" He checked himself and turned to Jane.

"Would you excuse us, Miss Wilson? Private business. If you'll give us a second—"

"Of course," she said. She turned and walked away from them alongside the pool, into the deepening twilight. The dolphins paced her in the water. The sun was just down now, and with the sudden oncoming of tropical night, stars could be seen overhead.

"Just let me tell you," said Mal. "It's about the research."

"I'm sorry," said Brayt. "There's no point in your telling me now. I'll be gone a week and I want you to watch out for this Jane Wilson, here." He lowered his voice slightly. "I talked to *Background Monthly* on the phone this afternoon, and the editor I spoke to there didn't know about the article, or recognize her name—"

"Somebody new," said Mal. "Probably someone who didn't know her."

"At any rate it makes no difference," said Brayt. "As I say, I'm sorry to tell you in such a rushed fashion, but Willernie has decided to end its grant of funds to the station. I'm flying to St. Louis to settle details." He hesitated. "I'm sure you knew something like this was coming, Mal." Mal stared, shocked.

"It was inevitable," said Brayt coldly. "You knew that." He paused. "I'm sorry."

"But the station'll fold without the Willernie support!" said Mal, finding his voice. "You know that. And just today I found out what the answer is! Just this afternoon! Listen to me!" He caught Brayt's arm as the other started to turn away. "The dolphins have been trying to contact us. Oh, not at first, not when we experimented with captured specimens. But since we opened the pool to the sea. The only trouble was we insisted on trying to communicate by sound alone—and that's all but impossible for them."

"Excuse me," said Brayt, trying to disengage his arm.

"Listen, will you!" said Mal, desperately. "Their communication process is an incredibly rich one. It's as if you and I communicated by using all the instruments in a symphony orchestra. They not only use sound from four to a hundred and fifty kilocycles per second, they use movement, and touch—and all of it in reference to the ocean conditions surrounding them at the moment."

"I've got to go."

"Just a minute. Don't you remember what Lilly hypothecated about the dolphin's methods of navigation? He suggested that it was a multivariable method, using temperature, speed, taste of the water, position of the stars, sun and so forth, all fed into their brains simultaneously and instantaneously. Obviously, it's true, and obviously their process of communication is also a multivariable method utilizing sound, touch, position, place and movement. Now that we know this, we can go into the sea with them and try to operate across their whole spectrum of communication. No wonder we weren't able to get across anything but the most primitive exchanges, restricting ourselves to sound. It's been equivalent to restricting human communication to just the nouns in each sentence, while maintaining the sentence structure—"

"I'm very sorry!" said Brayt, firmly. "I tell you, Mal. None of this makes any difference. The decision of the Foundation is based on financial reasons. They've got just so much money available to donate, and this station's allotment has already gone in other directions. There's nothing that can be done, now."

He pulled his arm free.

"I'm sorry," he said again. "I'll be back in a week at the outside. You might be thinking of how to wind up things, here."

He turned with that, and went away, around the building toward the parking spot of the station copters. Mal, stunned, watched the tall, slim, broadshouldered figure move off into darkness.

"It doesn't matter," said the gentle voice of Jane comfortingly at his ear. He jerked about and saw her facing him. "You won't need the Willernie funds any more."

"He told you?" Mal stared at her as she shook her head, smiling in the growing dimness. "You heard? From way over there?"

"Yes," she said. "And you were right about Brayt. I got your answer for you. He was a hatchet man—sent here by the Willernie people to decide whether the station deserved further funds."

"But we've got to have them!" Mal said. "It won't take much more, but we've got to go into the sea and work out ways to talk to the dolphins in their own mode. We've got to expand to their level of communication, not try to compress them to ours. You see, this afternoon, I had a breakthrough—"

"I know," she said. "I know all about it."

"You know?" He stared at her. "How do you know?"

"You've been under observation all afternoon," she said. "You're right. You did break through the environmental barrier. From now on it's just a matter of working out methods."

"Under observation? How?" Abruptly, that seemed the least important thing at hand. "But I have to have money," he said. "It'll take time and equipment, and that costs money—"

"No." Her voice was infinitely gentle. "You won't need to work out your own methods. Your work is done, Mal. This afternoon the dolphins and you broke the bars to communication between the two races for the first time in the history of either. It was the job you set out to do and you were part of it. You can be happy knowing that."

"Happy?" He almost shouted at her, suddenly. "I don't understand what you're talking about."

"I'm sorry." There was a ghost of a sigh from her. "We'll show you how to talk to the dolphins, Mal, if men need to. As well as some other things—perhaps." Her face lifted to him under the star-marked sky, still a little light in the west. "You see, you were right about something more than dolphins, Mal. Your idea that the ability to communicate with another intelligent race, an alien race, was a test that had to be passed before the superior species of a planet could be contacted by the intelligent races of the galaxy—that was right, too."

He stared at her. She was so close to him, he could feel the living warmth of her body, although they were not touching. He saw her, he felt her, standing before him; and he felt all the strange deep upwelling of emotion that she had released in him the moment he first saw her. The deep emotion he felt for her still. Suddenly understanding came to him.

"You mean you're not from Earth—" his voice was hoarse and uncertain. It wavered to a stop. "But you're human!" he cried desperately.

She looked back at him a moment before answering. In the dimness he could not tell for sure, but he thought he saw the glisten of tears in her eyes.

"Yes," she said, at last, slowly. "In the way you mean that—you can say I'm human."

A great and almost terrible joy burst suddenly in him. It was the joy of a man who, in the moment when he thinks he has lost everything, finds something of infinitely greater value.

"But how?" he said, excitedly, a little breathlessly. He pointed up at the stars. "If you come from some place—up there? How can you be human?"

She looked down, away from his face.

"I'm sorry," she said. "I can't tell you."

"Can't tell me? Oh," he said with a little laugh, "you mean I wouldn't understand."

"No—" Her voice was almost inaudible, "I mean I'm not allowed to tell you."

"Not allowed—" he felt an unreasoning chill about his heart. "But Jane—" He broke off fumbling for words. "I don't know quite how to say this, but it's important to me to know. From the first moment I saw you there, I . . . I mean, maybe you don't feel anything like this, you don't know what I'm talking about—"

"Yes," she whispered. "I do."

"Then—" he stared at her. "You could at least say something that would set my mind at rest. I mean . . . it's only a matter of time now. We're going to be getting together, your people and I, aren't we?"

She looked up at him out of darkness.

"No," she said, "we aren't, Mal. Ever. And that's why I can't tell you anything."

"We aren't?" he cried. "We aren't? But you came and saw us communicate— Why aren't we?"

She looked up at him for the last time, then, and told him. He, having heard what she had to say, stood still; still as a stone, for there was nothing left to do. And she, turning slowly and finally away from him, went off to the edge of the pool and down the steps into the shallow water, where the dolphins came rushing to meet her, their foamy tearing of the surface making a wake as white as snow.

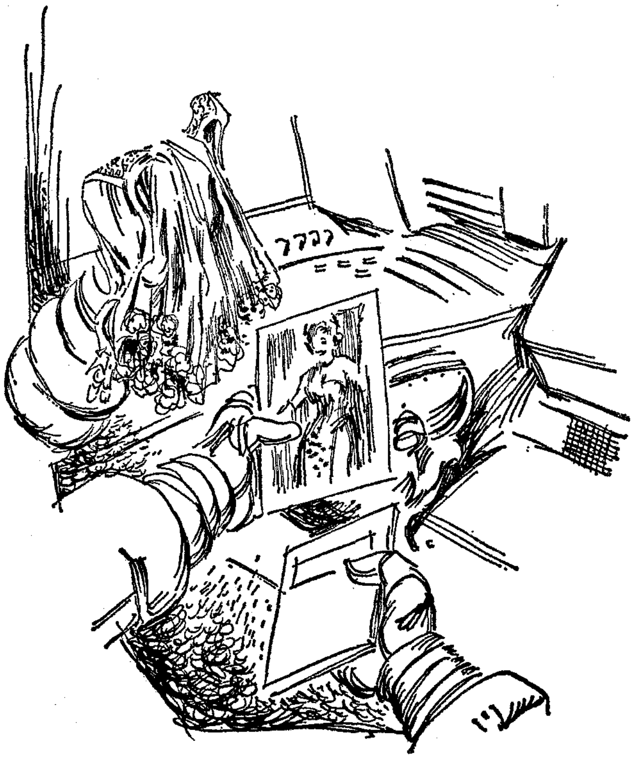
Then the three of them moved, as if by magic, across the surface of the pool and out the entrance of it to the ocean. And so they continued to move off until they were lost to sight in darkness and the starlit, glinting surface of the waves.

It came to Mal then, as he stood there, that the dolphins must have been waiting for her all this time. All the wild dolphins, who had come to the station after the first two captives, were set free to leave or stay as they wanted. The dolphins had known, perhaps for centuries, that it was to them alone on Earth that the long-awaited visitors from the stars would finally come. ■

THE ANALYTICAL LABORATORY

PLACE	STORY	AUTHOR	POINTS
FEBRUARY 1964			
1.	Dune World (Conclusion)	*Frank Herbert*	1.73
2.	The Permanent Implosion	*Dean McLaughlin*	2.14
3.	Rx for Chaos	*Christopher Anvil*	2.58
4.	Crackpots, Inc.	*Richard L. Davis*	3.45
MARCH 1964			
1.	Spaceman (Pt. 1)	*Murray Leinster*	1.61
2.	Outward Bound	*Norman Spinrad*	2.02
3.	Third Alternative	*Robin Scott*	2.66
4.	The Pie-Duddle Puddle	*Walt and Leigh Richmond*	3.79

THE EDITOR



SNAP JUDGMENT

J. T. McIntosh

There always have been, and always will be, times when you've got to make snap judgments on inadequate evidence. How the result comes out then is more luck than sense!

ILLUSTRATED BY LEO SUMMERS

There was not much room for a starship to maneuver between the blue planet and its craggy satellite, less than two hundred forty thousand miles away. It was partly for this reason that the Grillan starship *Zot* botched the job, despite all the anxiety of her commander, Captain Fird, to get everything exactly right. Having no precise knowledge of the capacities of the practically unknown race who called themselves *humans,* he was taken by surprise by the reaction speed they could achieve under stress.

The starship picked out a small, isolated ship with no trouble, matched velocities flawlessly, blanketed all possible incoming or outgoing radio transmission, and snapped tractors neatly on nose and tail. So far so good. No sooner had she done so, however, than a tiny escape ship burst from the captured vessel and flashed on toward the Moon—thus defeating the whole object of the exercise, which was to capture a specimen of the race *human.*

"Shall I destroy the escape vessel, captain?" asked Thrum. As the *Zot's* Second he was also the chief gunnery officer.

"Of course not!" Fird snapped, trembling at the very thought. "This whole affair must be handled with the utmost delicacy as well as extreme speed. You ought to know better than to suggest such a thing, Thrum . . ."

Captain Fird's voice faded as he realized that Thrum was shaking in silent amusement.

"Excrutiatingly funny," said Fird coldly. "One day, Thrum, you'll realize that while a Second may be able to indulge a sense of humor, it's a luxury which no captain can afford. Now board that ship and see what you can find. With any luck one of the humans may have been left behind."

If the captain stayed on the *Zot,* Thrum had to go with the boarding party. Grillan command was not a pyramid. It was a two-unit system of rulers and obeyers. Fird and Thrum, who scarcely differed in rank—only in responsibility—were the only members of the twenty-man crew who decided anything. Should either of them die in space, the other assumed command and immediately appointed a Second from the crew.

No one, however, should die on the present mission. This, the first contact between the humans of the planet Earth and the Federation to which Grill and nearly every other intelligent race belonged, was entirely peaceable in purpose. Peaceable and legal, if not morally impeccable.

Waiting in the control room, Captain Fird fervently wished that his superiors either had not thought of their brilliant plan to take advantage of the presumed gullibility of these humans, utterly inexperienced in galactic politics, or had thought of it sooner. As it was, he had two Terran days at the outside. Two days in which to make a quick guess about human character and personality, contact them, put his proposition to them and depart with their answer. Two days in which to succeed or fail.

A communication box on the wall began to whistle. Fird spoke the key word. Thrum's voice came to him as plainly as if they were in the same room.

"Captain, there's nobody on board."

Fird made an exclamation of displeasure but not surprise. "Then they all escaped?"

"As far as I can make out, there was only a single human on board."

This was interesting. "Do these creatures, then," said Fird, "need bulky, elaborate apparatus to carry their living environment into space? This is a small ship, true, but very large to transport only a single creature . . ."

"No, it's not that, captain. I think this ship could hold about a dozen Earth people. But the fact is, we've only found indications of one. Want to come over? All you'll need is an ordinary Number 7 suit."

Fird did go over. In one way it was an excellent thing that the captured ship had contained only one Terran. This made it unlikely that much would be made of the incident.

Indeed, from some points of view it was no tragedy that the plan to capture a human had failed. If they had succeeded in the attempt, explanations and apologies would have been necessary, and some compensation would have had to be arranged for the captured Terran on his release. Now there should be no such trouble. On the other hand, what at best would have been a snap judgment on these humans now became the wildest of guesses based on the scantiest of information. There was no question of making another attempt to capture an Earthman.

The Grillans did know Terran spoken language, more or less, that there was only a single intelligent race and that its technological rating, though still low, was rising with unusual rapidity. Beyond this all was conjecture. You couldn't find out much from radio programs half of which consisted of music and most of the rest of fictional features of one type or another, all evidently designed to sell something.

Fird found his Second, more elaborately suited than himself, in a control room not startlingly unlike the one in *Zot.* Terrans used the same part of the visual spectrum, evidently, and were of roughly the same size as Grillans, if not shape. Apparently they rested sitting or lying instead of leaning, and used their upper manipulators exclusively. All switches and controls were from three to seven feet up—there was a significant absence of complicated controls within a couple of feet of the floor. Possibly Terrans also lacked sight except from a fixed point somewhere high on their bodies.

This was interesting but not at the moment relevant. With only two days to do a job, all Fird could allow himself to be concerned about was Terran psychology. To find out how these people reacted and make them react in the way he wanted—inside two days—that was his sole reason for making first contact with them.

"All we can afford now," Fird went on as if Thrum had not spoken, "is some listening to Terran radio before we make our first move. We might get television, too. The automatic monitor station which our exploration ship set up ninety years ago can't pick up TV signals, but we should be able to do it here."

They went to the lounge and had the radio technician pipe them some Terran radio.

"What do you do, actually?" said the blonde from Boston, snuggling closer.

Vince Barker, who had been angling for this question, laughed deprecatingly and tilted his gold-braided cap at a more rakish angle. He didn't expect he was going to get very far with this Boston blonde, but at the moment she was all that was available at a very dull political party not a hundred miles from the Pentagon. It was very late—too late even to change horses in midstream—and the gardens were warm and dark.

"Well, my actual title is Space Contact Officer," he said. (That "actual" was catching.) "That means that when Creatures land from Outer Space I'm sent for to tell the President what to do."

"How too fascinating," said the blonde. "But there aren't really any creatures in outer space, are there, actually?"

She knew as little as might be expected.

"On the contrary," he said, "we've known for nearly fifty years now that there most definitely are. As our measurements and calculations become more and more exact, we've been able to detect signs of activity near various suns which could only be explained by the presence of intelligent beings there."

"Oh!" she breathed. "Then why don't we go and talk to them?"

"Because we're at least a century short of interstellar travel. But *they're* not. We've been able to detect vast galactic journeys at many multiples of light-speed. *They* can do it, if we can't. That means that at any moment some of them might turn up here. Hence my appointment."

"How too fascinating. But . . ."

Barker waited politely.

"What do you *do,* actually?" she asked at last.

"You might say I'm an expert in possible situations. Put another way, I'm an expert in science fiction. You see, for quite a long time now people with imagination have been seriously considering all the things that *might* happen when the first contact with another intelligent race is made. Whether serious or frivolous, most of their theories have a certain value, even if only negative value. Someone like me who has studied all the ideas on the subject, from whatever source, at least knows what to avoid."

"How interesting."

But she didn't sound very interested any more. She had heard enough.

Barker was not really sorry when a white-coated servant emerged into the garden calling his name. "S.C.O. Barker! Is S.C.O. Barker here?"

Barker rose to his feet, cheerfully abandoning the blonde. "Here," he said. "What's the matter?"

Five minutes later he was in a car being rushed to Space HQ. Alone but for the driver, he was philosophical and unexcited. In a job like his, the first alarm was exciting. The two hundred seventh false alarm was mere routine.

The trouble was, most alarms came late and he lost a night's sleep before he was able to establish beyond all doubt that there was nothing in them. Nearly two hundred times he had staggered home in the early dawn, bleary-eyed and uneasily full of coffee and sandwiches. This time the coffee and sandwiches would rest more uneasily on top of champagne and caviar.

It was only to be expected that most alarms would come at night, he reminded himself. There was nothing less suspicious than a sunlit sky. It was only after dark that lonely, too-imaginative people saw bogymen.

The only officer in the operations room was Major Linwell, and he was just going. "May be something for you, Barker," he said indifferently. "Anyway, I had to call you. Actress claims her ship, en route to Lunapolis, was stopped by a large vessel that couldn't be Terran. She dived into the lifeboat and reached the Moon in that."

"Actress?" queried Barker.

Linwell was already nodding skeptically, anticipating his thought. "I know. Actress, night-club singer. Half known. Twenty-six. Exactly the type at exactly the age to do anything for publicity. Knows if she doesn't hit the jackpot soon, she's never going to."

"What about the others on the ship? What did they see?"

"There were no others on the ship."

"Huh?"

"It was one of those automatic ships that the space lines use for their contract jobs. If the regular flights can cope, the automatic ships don't run. If not, the automatic ships run with anything from one passenger to a dozen."

"Yes, I know about them. How come the ship ran just for one actress-singer who isn't even famous?"

"This dame has two spots just now, one in New York and one in Lunapolis. She shuttles to the Moon and back twice a week."

"And it *would* be the time she was alone that something happened," Barker remarked. "*If* something happened."

"You'll soon have a chance to check for yourself," Linwell said, picking up his coat. "The spaceline's bringing the ship back here instead of sending her on to the Moon."

"Good. She responds to control?"

"Yes, but they say they did lose all contact for forty-five minutes. As for the girl, she'll be back in New York in about six hours. You could have her brought here if you like."

When he asked Thrum: "What have you found?" he knew that his Second would show him only items which bore on the main point. This was no time for humor—the sooner they cast off the better.

And Thrum duly stuck to the point. "Two photographs," he said briskly, producing them. "Probably of the person who was traveling in the ship."

"How do you figure that?"

"Because one is identical with a picture stuck on a travel document, probably a passport."

Fird looked at the photographs. One, showing what was evidently the face, was colored but colorless. The other, showing the entire body, was startling vivid. Terrans were two-armed vertebrate bipeds not unlike Xyflans, and they wore a certain amount of clothing. The fact that they wore footcovering confirmed Fird's hypothesis that they did not use their feet for manipulation. Probably they did not need to—the hands looked quiet strong and capable.

Fird handed the photographs back, with a grunt to cover the fact that they didn't suggest much to him. "What else?"

"These." Thrum showed him two pairs of shoes. One, more or less flat, indicated what was almost certainly the natural shape and position of the human foot. The other, silvery, shiny, delicate, had a grotesquely high heel.

"This." Thrum produced a container which held a stick of fatty coloring material. The difference between the coloring in the two photographs was now explained. One showed the Terran's face without artificial coloring and the other with.

"These." What the Second produced for his captain's inspection were clearly garments, though filmy and impractical. It was obvious at a glance that their primary purpose was not to keep the creature efficiently insulated from cold and heat. Also there were lacy elaborations and ornamentations which seemed to serve no useful purpose.

The other items which Thrum showed Fird merely reinforced and developed the conclusions he was already reaching.

"Very well," Fird said. "We can cast off now. What will happen to the ship?"

"Its control is automatic. Once we remove the tractors and the radio blanket, it will respond to Terran control again."

"Good. You have left everything on this ship exactly as you found it?"

"Apart from a few tools, handprints, and some scribbled notes, there's nothing left around to show we've been here."

Fird ignored this. Thrum was trying to be funny again.

Back on the *Zot,* the small Terran ship released, it was necessary for Fird to compare notes with his Second. Thrum might have guessed something he'd missed, and Fird couldn't afford to take the risk of missing anything.

In the control room of the starship they were alone except for an engineer whose ear flaps were decorously closed.

"Very well, Thrum," said Fird, "please let me have your conclusions and I shall check them against mine."

But at Thrum's sarcastic voice-clearing, Fird changed his mind. "On second thought, I'll give you my conclusions and you will comment on them."

Thrum had no excuse for sarcasm any more.

"The high-heeled shoes are, of course, extremely significant," said Fird. "They indicate a desire for self-aggrandizement. The red color-stick shows that humans reinforce certain physical characteristics even when there can be no possibility of deception. The clothes worn in the photograph are evidently intended entirely for adornment, since such material covering such a relatively small proportion of the surface area can have no significant heat-insulating effect."

Thrum politely indicated assent by extending and contracting his feet.

"My conclusions," said Fird firmly, "are that these people go to immense pains to make themselves attractive to others of their species; that comfort and reality are sacrificed to their desired image of themselves; that they pretend to possess attributes and characteristics which they do not, knowing the pretense is transparent; that they are consequently extremely open to flattery, easily deceived, quite willing to be deceived, incapable of resisting their own desire to be *liked.*"

Thrum's agreement was really quite respectful.

Fird continued: "They attempt to create an aura of mystery and would be intrigued by mystery concerning a stranger. Their speed of reaction to danger suggests that in such circumstances they rely on intuition rather than logic. This in turn suggests that they are romantically rather than realistically inclined. In sum: a highly emotional race, insecure and with certain parasitic qualities, intuitive, unstable, with a capacity and possibly even a desire to be dominated by a stronger race."

Thrum was no longer impudent. He made no attempt to conceal the fact that he was greatly impressed by Fird's summary.

"Anything to add?" the captain asked politely.

"Nothing . . . Except, as you haven't forgotten yourself, that we only have one sample. If the psychological spread of these Terrans is wide, your conclusions, though quite correct as regards a single Terran, might be misleading when applied to the mass."

"That can't be helped," said Fird, worried again. "We must leave in less than two days. We have no choice but to make a quick guess and back it. It would be too risky to stop more ships, even if we had the time—the Terrans might take this as an act of war and all chance of fulfilling our mission would be at an end."

"It's possible they might object," agreed Thrum, shaking with mirth.

Barker sighed. "Another all-night session. I'll have to turn the ship inside out and wait here for the girl, I guess. What's her name?"

"Doreen Nox."

"Doreen . . . Say, I know her. At least, I've seen her act. Passable voice, but you're supposed to look rather than listen."

"Then you're in luck. Since they decided girl plotters weren't a good Security risk, there hasn't been one around here. Well, I leave you to it, friend."

Major Linwell hesitated and then added, half jokingly: "Of course, if there should turn out to be anything in this, you could blast the President out of his bed and get the whole Army and Navy on the job."

"And if there shouldn't, I'd better not spend ten unnecessary cents or I'll be in hot water."

Linwell grinned. "I see you've got the picture." He left Barker alone in the operations room.

The S.C.O. was not impressed by what he had heard so far. It wasn't often that even an automatic ship traveled with a single passenger. Why did it have to be on just such an occasion that something happened to her? The most natural explanation was that a publicity-hungry actress had taken deliberate advantage of the favorable circumstances of being alone, of having no one to deny any story she chose to tell.

The phone at the end of the long operations table rang. Barker had quite a walk to answer it.

The sergeant at the other end sounded surprised. "S.C.O. Barker?" he said. "At Space HQ after midnight? Well, who'd have thought it?"

"Cut the sarcasm," Barker snarled. "If you've anything to say, say it."

The sergeant's attitude had changed. "Well, if you're there already, maybe there is something in this . . . Radar section here. We've found a hole between here and the Moon."

"A what?"

"A hole. It's not an object, unless an object that knows how to pretend it's not there in ways *we* don't know about. We thought it was an unusual kind of electrical disturbance."

"Constant in position?"

"Constant in the ten minutes we've had it on the screen."

"Only ten minutes?" The Doreen Nox incident must have been hours earlier. By the time he heard about it she had reached the Moon and was on her way back.

"It could have been there for days. We don't spend our time looking for things that aren't there."

Barker noted the position and hung up. He was becoming interested.

When he had some excuse to exercise it, Vince Barker's authority was practically unlimited. As the next few hours passed he found he had more and more excuse, until the point of no return was reached. After that, he'd have needed strong excuses to drop the matter if he wanted to.

The space line concerned informed him that control of the automatic ship had been cut so abruptly that the only possibilities seemed at the time to be destruction of the ship or explosion of the entire radio installation. They had an emergency call out for thirty-two minutes. Then, suddenly and inexplicably, they had their ship under perfect control again.

No unqualified person on board the ship as a passenger, they declared categorically, could have produced this effect deliberately. Besides, the lifeboat would not be released if the ship were on course and functioning perfectly.

It began to look as if Miss Doreen Nox, actress, could hardly have invented the whole thing for reasons of publicity. You couldn't do a thing as a publicity stunt when you couldn't do it at all. (Though there did remain the possibility, Barker thought shrewdly, that *something* had happened and for reasons of her own Doreen Nox decided to inflate it into invasion from outer space.)

He saw the ship immediately after the spaceline technicians' inspection, and neither they nor he learned anything. Everything on the ship appeared to be exactly as Doreen Nox had left it. Since she had been the only passenger, there was practically nothing on board which didn't belong to her. On no flight did spacelines carry anything extra for any reason whatever.

If there had been any strange visitors, even their smell was gone. The supremely efficient air-conditioning revealed nothing either. But visitors in spacesuits, human or otherwise, didn't leave any dust.

There being no further developments, Barker sent a message to the New York police. Doreen Nox would be delivered to him within minutes of her arrival at New York. Her wishes, whatever they might be, would not be consulted.

At the first gray light of dawn, Barker was still alone in Space HQ, not having learned enough yet to call out the President, the Army and the Navy.

However, soon he would have the company of Doreen Nox. She might, for one reason or another, turn out to be considerably more interesting than the blonde from Boston.

Silently the linquistics expert handed over his translation, in the form of a continuous roll which, once read, was back in position to be read again. Not having been asked to speak, he did not.

Fird took the roll and read:

VITARENE gives you pep and bounce!

Are you beginning to feel your age? Do you have that under-par feeling? Do things get on top of you?

VITARENE will put *you* back on top—on top of the world.

(Pause: different voice)

What's so specal about VITARENE? Why is it able to do such a wonderful job? What has VITARENE got that the others haven't got?

The answer is—Caliprene!

> Tests have shown that in addition to ordinary vitamins the body *needs* Caliprene. Caliprene is available only in VITARENE. VITARENE with Caliprene. Your body *needs* Caliprene. Give it what it needs from now on—VITARENE with Caliprene.

Fird passed the roll to Thrum.

"Much the same as the others," Thrum commented.

"Not quite," Fird said. "There are two main approaches—*be younger, healthier,* and *be more sexually attractive.* This one concentrates on the first. Numerically there are more of the second type. Like this one."

He picked up a roll they had read earlier, glancing over it again. It read:

> Use GOLDHAZE and be *sure.*
>
> It's no use just *looking* necessary. You need physical harmlessness as well. GOLDHAZE gives you physical harmlessness.
>
> When you're out on that important meeting . . . when you're out, it's too late. If you haven't already ensured physical harmlessness, you may offend . . . and mutual feeling is terminated.
>
> GOLDHAZE gives you physical harmlessness. You can't be attractive (necessary? compelling? alcoholic?) without physical harmlessness.
>
> *Before* that important meeting (with a person of another sex) use GOLDHAZE and be *sure.*

In this translation, far more than in the other, the linguistics expert had been compelled to mark several words and phrases as doubtful. *Necessary* was one. *Physical harmlessness* was another. The word for *meeting* seemed, he noted, to mean more than just a meeting. *Offend* was an approximation. The word for *attractive* was so doubtful in meaning that he felt bound to add three alternatives. The second word for *meeting* was different from the first, evidently including a certain emotional content.

Why one passage was translated with confidence and accuracy and the other with no confidence at all was no secret to the linguistics expert or Fird or Thrum.

The Grillans were monosexual. Naturally words in any language referring directly or indirectly to bisexuality must give them a lot of trouble.

"Clearly sex is of major importance to these people," Thrum agreed. "Wonder what they do . . . exchange buds, share the job of fertilizing eggs, or unite physically? Funny that sex should be so important and yet we can't get a clue about the mechanics of the operation from all this material."

"At least we know there are two sexes, physically different," said Fird. "I wonder how great the difference is?" Worried by a strong feeling that he might be missing something, as he had been most of the time since he had arrived in the solar system which included Earth, Fird couldn't quite pin it down. Somehow he had the idea that he was making a naïve mistake which should be obvious, and yet couldn't see it.

"However great the difference is, we can ignore it," said Thrum, and laughed.

Fird frowned at the laugh. Remembering the presence of the linguistics expert, he turned to him and said: "Thank you, that will do."

The Grillan made a gesture of respect and left Captain Fird alone with his Second.

"Why did you laugh?" Fird demanded.

"It's so ridiculous that we, a monosexual race, should be trying to figure out the importance of sex to a bisexual race. How *can* we understand it? We don't understand the three bisexual races we do know, at any rate from a sexual angle, and we've got far more information about them than about these Terrans."

"So you would ignore the bisexual angle altogether?"

"Why not, since we can't possibly understand it? Anyway, we get on with the Pypreans simply by ignoring their bisexual cycle, don't we?"

"Why did you say that, however great the difference between the two human sexes is, we can ignore it?" Fird asked.

"Obviously when two races are quite alien to each other physically, like us and these Terrans, any differences *within* either race are negligible compared with the vast differences between the two races as a whole."

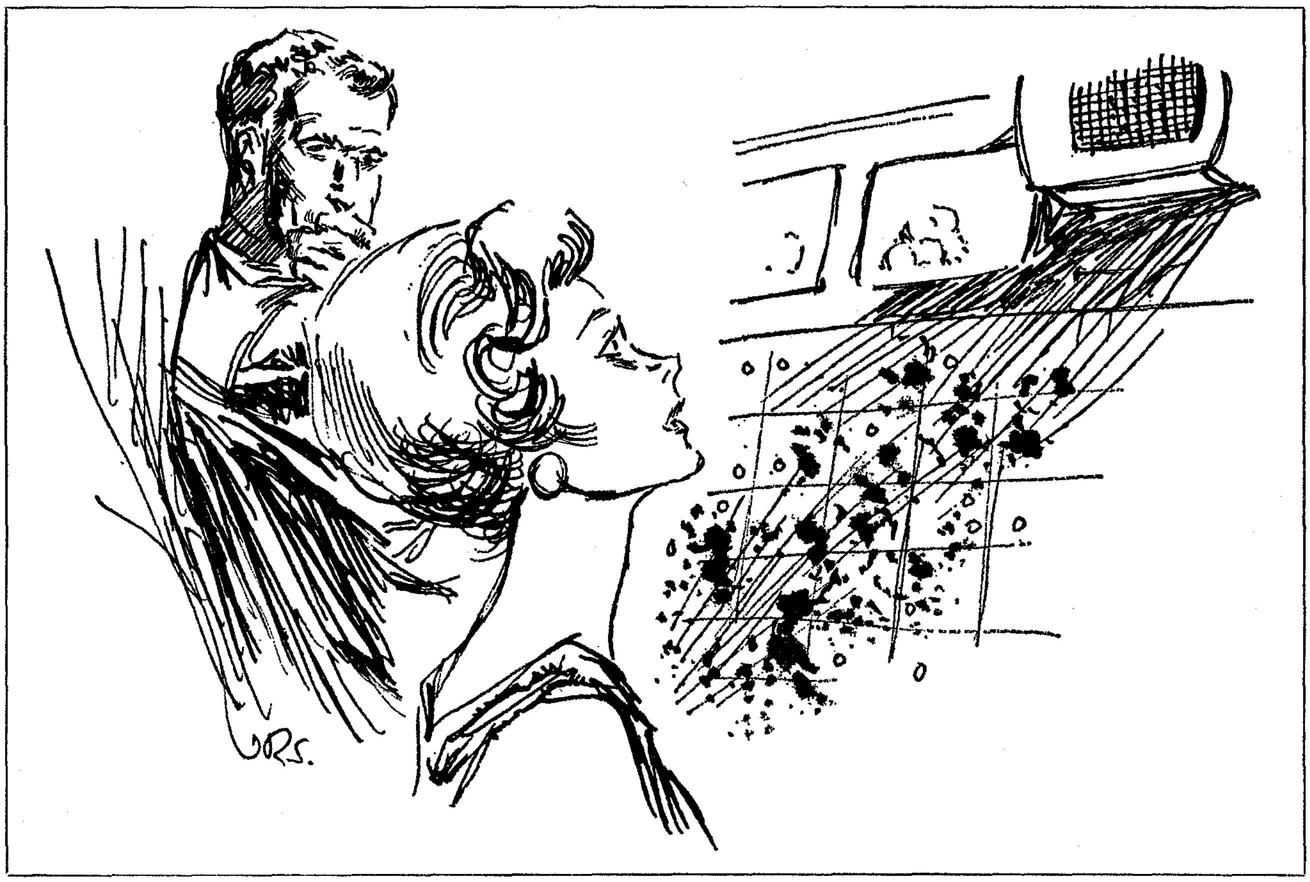
Fird was silent for a moment, thinking. What Thrum said sounded reasonable. But then, Thrum was not responsible for what was done in this brief visit to Earth. Fird was. It was Fird who had to decide what was important and what was not.

At first Fird had been confident about his guesses based on the information they had been able to collect about the Earthmen. He still had to operate on the same guesses.

Yet his guesses about Terran psychology more or less assumed that Terrans in mass would react as he had decided the Terran in the captured ship would react. And although everything in the radio messages which he and Thrum had had translated confirmed what he had already decided—that the Terrans were at the mercy of their own desires for self-aggrandizement, their own hunger to be young, healthy and attractive, and were, therefore, wide open to flattery; that they were insecure, intuitive, unstable, and with a desire for domination by someone stronger—although almost everything they knew about the Terrans reinforced this judgment, Fird was anxious about the obviously important sex factor which he could not understand. He had no idea what mistake he was liable to make in his ignorance, but was uneasily certain that there were many fatal errors he could make.

In the end, however, he decided that Thrum was right. He had no choice but to ignore the unknown factor in the equation for which he could derive no probable value.

"Anyway," he said, making up his mind, "all these translations from Terran radio confirm the humans' willingness to deceive themselves."



"You could be wrong," said Thrum. "Maybe some of them do believe this stuff."

"No," said Fird definitely. "We know such appeals work on these Earth people, or they wouldn't be tried. But I'm certain from what we know already that they semiconsciously allow themselves to be persuaded . . . they *like* pretense and they pretend to believe pretense. Romance—that's it. Give them a fairytale to believe and they do their best to believe it. Vitarene makes you young again. If you find that hard to believe, you can believe in Caliprene. Only Vitarene has Caliprene. Therefore, naturally, nothing else can be expected to act as Vitarene acts . . ."

"The question is, how are *we* going to act?"

Fird didn't answer at once. "It's a pity we can't make out the television pictures."

"Sure," said Thrum. "I like a good drama."

Unfortunately Terran television worked on a scanning principle. Grillan vision also worked on a scanning principle, but the periodicity was incompatible. They could receive Terran TV pictures all right, but could not make them out on the screen. Although in time a solution could be found, the technicians said they couldn't do anything within a few hours.

So they only had Terran radio to go on.

"I suppose you're aware," said Fird at last, "that what we're doing here is just barely legal?"

Thrum shook with silent laughter. "Yes, captain. I'm aware of that."

"We're relying on a loophole in Federation law. We're not allowed to trade with unaffiliated worlds, or interfere in their internal politics, or give them technological assistance. However, technically these Terrans are in P sector and theoretically entitled to vote in Federation elections. There is no actual prohibition in Federation law preventing us from collecting and registering the Terran vote."

Thrum nodded. "And since we hope Grill needs just one vote to beat Xyfle, we're here to try and get it. We've nothing to lose."

"*You* may have nothing to lose. As captain, however, I have a good deal to gain or lose."

"Well, by the time this scheme was thought of, you'd only time for a couple of days here if you were to make the election with the Terran vote. They can't shoot you if we fail."

"We are not going to fail," said Fird stiffly.

"O.K., how are you going to ensure success?"

"We know the Terrans are very open to flattery. So we must make it clear to them that the whole result of the election depends on them. That will ensure that they vote."

"Fine. Now what ensures that they vote our way?"

"Their desire to be liked. When they know of our existence, they'll want us to like them."

"Sounds very simple."

"I hope it *is* simple."

But Fird was looking worried again.

Doreen Nox was beautiful, which was not surprising, and very angry, which was.

Just after eight a.m., a military guard firmly manhandled her into the long operations room of Space HQ and then withdrew at Barker's nod.

Thereupon the actress spoke for five minutes, and Barker did not interrupt her once.

She was a tall, leggy redhead dressed in a coat which must have set somebody back five figures if not six. But Barker, shrewdly observing her instead of listening, since she was saying nothing of any importance, merely complaining about the way she had been treated, noticed that her shoes were not new and the dress which showed slightly under the coat was not an expensive one. He concluded that, like most of her type, Doreen Nox alternated uneasily between wealth and penury.

Finally she stopped.

"Ready to talk sense now?" Barker asked politely.

She was not. She started complaining again about the way she had been picked up like a criminal at the New York spaceport and rushed to Washington.

Barker devoted his attention to the sector map on which he had already placed the radar section's "hole in space" and the estimated position of Doreen's ship when the automatic control was lost. They coincided.

Ignoring the redhead was a luxury which he was not permitted for long. With surprising strength she spun him round to face her.

"Listen, you, whoever you are," she said angrily. "I'm not wasting my time talking to empty air. I—"

"You're wrong," said Barker. "You have done nothing but waste your own time and mine since you came in here. I'm patiently waiting for you to start being reasonable—or as reasonable as you know how to be, anyway."

Unwisely she tried to hit him. He didn't let her. In the struggle her coat came off and he threw it on a chair. Suddenly in her cheap dress she was no longer able to pretend to be someone who mattered.

"Right," he said, releasing her. "Your ship was stopped by a larger ship. What did you make of her?"

"She wasn't an Earth ship," she said sullenly.

"How do you know?"

"I do a lot of traveling. I've been on practically all the ships that go to the Moon, and I've seen the Mars and Venus freighters. This ship was nothing like any of them."

"In what way did she differ?"

She was getting annoyed again. It was this annoyance that finally convinced Barker she was telling nothing more than the truth. If she'd invented lies for publicity, she'd have been delighted at being whisked away to Washington to be questioned by the Space Contact Officer. As it was, she was angry and didn't seem to know or care who Barker was.

"She was different," she said sarcastically, "because she wasn't the same."

"In what way was she not the same?"

The redhead shrugged. "Well. This ship was sort of rounder. And duller. And bigger. And there was no drive at the back. And . . . well, the shape was wrong. The whole feel was wrong. That's why I got away so fast in the escape boat."

"Feminine intuition?"

"Call it what you like."

"Thank you, Miss Nox," said Barker politely.

She was taken aback. "You mean I can go now?"

"Unless you want to see what develops."

"What's likely to develop?"

On cue, the phone rang. Barker picked it up. "S.C.O. Barker here."

"This is the radio section." The voice was excited. "You've heard nothing there?"

"About what?"

"Radio messages. Powerful and on several wave lengths. From somewhere between here and the Moon. A five-minute warning and then a three-minute warning about an important announcement. Can't be a hoax. There isn't a powerful enough transmitter in space to do what's already been done."

"If it isn't a hoax, what is it then?"

"Something for you!"

"I see. You haven't taken long to make up your minds about it in the radio section."

"Nobody's taken long to make up his mind. Nearly all the stations are saying they'll close down until after the announcement. Want me to pipe it through to you when it comes?"

"Sure. Do that." Barker hung up.

Doreen barely had time to ask him what was going on when all the loud-speakers fitted round the operations room told her.

At the first sound of the voice Barker realized why natural human skepticism had so quickly been overcome.

This wasn't a human voice. It was rich, warm, sensual, exciting, but it was more than foreign, it was alien. In thousands of science-fiction dramas on radio and TV, engineers had tried all the electronic tricks they could figure out to create a convincing Voice from Space. Some of their results had been thrilling and convincing—until this voice was heard. It was obvious at once that this was not simply the result of electronic tricks. They might have been applied afterwards, of course, but what existed in the first place was . . . different.

At the thought, Barker understood exactly what Doreen Nox had meant about her first sight of the strange ship. He glanced at her, but she was intent on the voice emanating from the loud-speakers.

It said simply: "An announcement of great importance will be made one minute from now. Please stand by."

In the silence that followed, the phone rang again.

At the other end, Personnel wanted to know if the Space Alarm was to be sent out at once.

"No," Barker said. "If the announcement is belligerent, you can send out the alarm without further reference to me. But we'd better wait till we know what it's about first."

Scarcely had Barker replaced the phone when it rang again.

"S.C.O. Barker," he said.

"Lewis. What measures are you taking, Baxter?"

F. X. Lewis was the President's right-hand man, generally known as PRHM, smoothed in conversation into Pram. If everyone was a bigger fool than he looked, or looked a bigger fool than he was, Pram looked a bigger fool than he was. Barker suspected that his habit of getting names wrong was deliberate, intended to show even the most important men in the country that they were not as important as they thought.

"Very few until I've heard this announcement," Barker said.

"Is it your considered opinion that this is a message from a ship from outside the solar system?"

"Yes."

Without another word Pram rang off. He was considered an awkward customer to deal with, but Barker had found that he was less awkward if you didn't hedge.

Replacing the phone, Barker glanced again at Doreen Nox. She was watching the nearest loud-speaker with an intentness which he found slightly puzzling. Although anyone would naturally be interested in the coming announcement, Doreen's absorption seemed a degree greater than might be expected. Perhaps the explanation was that she felt herself personally involved.

Without preamble the announcement began:

> People of Earth, we have come to you because we need you. We are happy that we Grillans have the honor of making first contact with you. We are different from you in body, but very similar in spirit. We, too, are a race which values love above all else.
>
> We are members of a great galactic Federation. And so are you. By the very fact of your existence, you have the same rights in this great Federation as we have. We have come to tell you you are no longer alone.
>
> As time is short, we must now tell you how and why we need you. Later there will be a time and place for friendship between you and us—and, we hope, between you and other races of the Federations as well. But we think you will find, when you learn more, that Earth people and Grillans have most in common. No other race values love as we do.
>
> We have spoken of the great galactic Federation to which we both belong. Why we need you now is because this Federation is in danger. But your entry into the Federation can destroy this danger in a moment. Your official entry is all that is needed to avert a crisis. You, the people of Earth, hold the key.
>
> Your world becomes a full member the moment you cast a vote in the Federation elections—free, democratic elections like your own. We ask you to help us to avert tragedy—and, in helping us, help yourselves. What we ask of you is a Terran vote for Grill in the coming elections. In two hours we shall explain how this vote can be registered. Please decide now.
>
> We have come to you, people of Earth, because we need you. We do not pretend we want nothing from you. We want a great deal from you. We want . . . we *need* your trust. We hope and believe you will give it to us.

The warm, thrilling voice stopped. Evidently this was all.

Barker was not surprised, now, to find that Doreen was still in a trance. Certain ideas were beginning to stir in his mind.

He phoned Radio. "Let me have public reaction as it comes in," he said. "Through the speakers, please. But no hysteria, no nut-case reports. I don't want to hear about fanatics shouting 'Hallelujah' or jumping off the top of the N.B.C. Building. Just what people really think. Your own reports, please."

As he put down the phone, it started to ring.

The caller was, of course, Pram.

"No, I'm not sounding an Alarm or even an Alert," Barker said.

"I think the President would feel happier if Space HQ stood at Alert, Banting."

"Then he can order it himself."

"You don't recommend an Alert, then?"

"That's what I said."

"What *are* you doing?"

"If you like to come over here, you'll find out."

"I'm not sure I can do that, Benson. It's a matter of being with the President and calling you or being with you and calling the President . . . Well, all right. I'll be with you in fifteen minutes."

Barker had been at Space HQ all night and there had been very little action. Now he very much wanted to go out and fit himself round a mansize breakfast. But he suspected that it would be quite a few hours before he would be able to leave the operations room.

He was pleased that Doreen showed no particular desire to leave him. He liked to look at her in the slack moments when there was nothing else to do. Soon Pram would arrive—there was nothing he could do about that. However, seeing no reason for any more company, he rang up Personnel and told them he didn't want anyone in the operations room until further notice.

Personnel told him that very shortly several generals and field marshals would arrive and would expect to be consulted before any major decisions were taken.

"As of now," Barker retorted, "no general or field marshal or admiral rates more than a corporal. Tomorrow they can kick me around and probably will. Meantime, tell them all to go home and not bother me."

Then he listened to some of the early public reactions to the Grillan announcement, reported by the radio section.

Then, very deliberately, he bent over and kissed Doreen Nox.

"Wake up," he said. "Remember me?"

F. X. Lewis was bald, toothy and plump. The only sharp thing about him was his eyes, and they were half hidden behind thick glasses.

"The President fully realizes the importance of the situation," he announced. "I hope you have some ideas, Barton."

"Lots," said Barker easily. "Let me introduce Miss Doreen Nox."

Evidently Pram had risen above sex. He surveyed Doreen with no interest whatever, indeed almost with distaste. "What's she doing here at Space HQ?" he demanded. "At such a time?"

"It wasn't my idea," said Doreen tartly. Since Barker had kissed her she had been very wide awake indeed. She was no longer angry. She didn't mind being kissed. She didn't mind being at Space HQ any more. In fact, having heard the Grillan announcement, she was now very interested in the whole thing and more than willing to stay where she was.

But she didn't like Pram any more than he liked her, and she made no effort to hide it.

"She was almost kidnaped by the Grillans," Barker said, and explained briefly.

"Oh," said Pram, passing her presence for the moment. "But why are only you and she here?"

"Because, now that you're here, we don't need anybody else," said Barker soothingly. "We don't need plotters, or generals, or technicians, or mathematicians, or tacticians, or hangers-on. All we have to do is decide what to do about that message. And I've already decided."

Pram was taken aback. "You take a lot on yourself, Barking."

"Remember, I'm suddenly very important."

"The President can still overrule anything you decide."

"Wrong, Mr. Lewis. The President and the Prime Minister of Britain and the German Chancellor and the French Premier and about a dozen others, maybe. But until they come to a joint, unanimous decision, I act as I see fit. I'm the Space Contact Officer, you know."

"Yes . . . well—" Pram sank into thought. He knew Barker's position all right. Perhaps he had not been quite sure if Barker did, or if Barker chose to use his full weight.

"You really can do as you like?" Doreen asked curiously, her new interest in Barker as a man growing.

"Until all the people who appointed me get together and unappoint me, yes."

An S.C.O. had been appointed because when the first space contact occurred, as any day it might, it might easily be necessary to have a man with absolute power to take drastic measures from the word go. A man whose job it was to know all he might have to know and to have thought about all he might have to do. A man whose importance one moment was nil and the next limited only by the degree of probability that contact with a race from another sun had actually been made.

Now when it happened there was no doubt. Public reaction, as reported by the radio section, was by no means unanimous except on one point—the Grillans really were from another sun. The only people who doubted this were those who had not heard any of the messages, and their views could scarcely count.

Most people *had* heard the message. In most households, at least one person was listening to the radio around breakfast time, and the five-minute warning had sufficed to drag everyone else in the house out of bed and even warn a few neighbors.

"You say you've already decided what to do, Benson?" Pram asked, frowning. "Before we discuss it, hadn't we better . . . ah . . . do we need Miss Nox any more?"

"If she doesn't insist on going," said Barker easily, "she might as well stay. She's a useful control . . . Doreen, if you had to decide what to do about the Grillans, what would you do?"

"Give them what they want," said Doreen promptly.

"Well . . . ah . . . that's a point of view," said Pram.

"Why," said Barker pointedly to Doreen, "would you do that?"

"Because it's obviously the right thing to do. Refusing would start us off on the wrong foot with the Grillans and not necessarily on the right foot with the other members of this Federation they mention. Agreeing would put us under their protection, make them grateful, put them under an obligation to us. In a way they'd be responsible for us."

Pram nodded, not to convey he was convinced, but to admit that there was something—more than he expected—in what she said.

Barker nodded, too, but remarked: "You're rationalizing, of course—finding reasons to justify your feeling that the right thing to do is vote for the Grillans."

"I guess so," Doreen admitted, as if it didn't matter.

"So you're taking a concensus of opinion, Barkley?" said Pram.

"No. This isn't going to be a democratic decision. It's going to be mine. A political decision based on what's best for us. But I don't mind finding out what the general view is. Listen."

The speakers, turned low so that it was possible to talk over them, were reporting:

> . . . No mass hysteria. The tone of the message seems to have reassured most people.
>
> Concerning what should be done, eighty to ninety per cent of women favor voting for Grill. Ten per cent of men favor this course, seventy per cent are undecided, twenty per cent favor voting *against* Grill.
>
> Most women who want to back Grill give no reason. The men who want to back Grill generally point out that it may not be safe to do anything else. They say the Grillans may turn aggressive if we oppose them. They add that there may be more ships—

Barker turned to Pram. "Well?" he said challengingly.

"Well what?"

"What would you do, Mr. Lewis?"

Pram was not to be drawn. "I think I'd better contact the President," he said.

When the Grillan ship began broadcasting again, she went on the assumption that Earth was going to vote. Barker found this not unreasonable. Earth could at any time say no; the Grillans, who didn't want a refusal, would be foolish to put the word *No* into Earth's mouth, so to speak.

Arrangements to register the Terran vote—on the tacit assumption that there was going to be one—proved surprisingly easy to make.

First the *Zot* asked, on several wave lengths as before, which single station was empowered to speak for Earth. "This one," said the Space HQ radio section promptly, moving to a frequency not available on ordinary domestic radio or TV, and holding it until the Grillans were able to match it and pinpoint its locality on Earth's surface.

Then the Grillans informed Barker that a small ship, scarcely more than a capsule, would be sent down to land on the nearest open space to the pinpointed radio station. The capsule, unmanned, would contain a voting sheet and a ballot box. Since no Terran could read Federation script and the Grillans understood only spoken Terran language, a recording machine in the capsule would contain a spoken line-by-line explanation of the voting sheet.

"Is the ballot secret?" Barker demanded. He was still in the operations room, using a microphone whose output the radio section could transmit direct.

It was interesting to measure the delay before an answer came. Presumably his question had to be translated into Grillan and the answer translated back into English. But the delay was longer than seemed necessary. The explanation might be discussion or further communication difficulties—possibly the voice which had so impressed the people of Earth, particularly the women, was an electronic creation.

Anyway, the reply took seven minutes.

The ballot was secret in that the Grillans would not, they said, be able to see the voting sheet without invalidating it. However, by Federation law all votes were declared after the election results were announced. Earth's voting sheet would then be available to all the members of the Federation.

"How long have we to decide?" Barker asked.

The question wasn't important. He merely wished to establish whether the reply again took seven minutes. If it took less or more, this would imply that discussion was going on and was the reason for the delay. If it took the same as the first answer, the probability would be that the delay was due to communications difficulties and that straight answers were being given.

The answer, in seven minutes, was: "The capsule will arrive in half an hour. We hope you will have made up your minds by that time. Remember how important this is, to you, to us, to the whole galaxy. We trust you. We need your confidence."

There was no further communication.

Wondering how the Grillans were going to transport a capsule one hundred thousand miles and land it on a precise spot in half an hour, Barker rang up Radar and asked if the hole in space had moved. Apologetically Radar reported that they'd lost contact over an hour ago.

"You might have told me," said Barker mildly, and put down the phone.

Meeting the eyes of Pram and Doreen, he said: "I guess I'd better have some more coffee and sandwiches sent in, huh?"

"What are you going to do, Barker?" Pram demanded. It was perhaps a measure of his concern that he forgot, for the first time, to get Barker's name wrong.

"I'm going out to that capsule myself. You and Doreen can stay here. Exactly what I do will depend on the precise form of the voting sheet."

"You said you'd made up your mind."

"Yes. But the form of the voting sheet may modify my plans."

Pram suddenly looked shrewd and tough. For the first time it no longer seemed inexplicable that such a man could be so important. "Barker, unless you tell me what you propose, I'm going to have you restrained."

"Restrained, Mr. Lewis?" said Barker softly.

"Arrested. Then the President and I will figure out between us what action to take."

"Being better qualified than the duly accredited Space Contact Officer?"

Doreen looked from one to another, curious, a mere spectator.

"I don't know about that," Pram retorted. "More responsible, probably."

"You'll have a lot to be responsible for, Mr. Lewis."

"What exactly do you mean?"

"You won't only be responsible for the decision you make. You'll be responsible to this nation and to every other nation in the world for removing the expert appointed to handle this situation."

"Well, tell me what you plan."

"No. Because the decision is mine. What you say about what I've decided, even what the President says, isn't of the slightest interest to me. America's Olympic team, wondering which of four runners to enter for the five thousand meters, doesn't send a cable to the President asking for a decision. I'm not sending a cable for a decision either."

"But we can't let you—"

"You can't do anything else. Unless you leave me alone, I'll resign. Later you'll have to explain why I, the man whose job it is to handle a situation like this, was superseded."

"There won't ever be one man in such a position again."

"Maybe not, but that's a matter to be decided. What *has* been decided is that in this particular situation what I say goes."

They stared at each other for several seconds. Then Pram said: "Guess I'll call the President."

When the capsule duly landed in the gardens outside Space HQ, Barker went out alone. There was no interference. The headquarters was in the area with the tightest military security in the American continent. And Personnel had somehow succeeded in heading off all the generals, marshals and admirals who wanted to give Barker the benefit of their advice. There might not have been a brass hat in the country.

The capsule was twelve feet high, ovoid but with circular rims as if an ovoid had been contracted over a cylinder. A five-foot door stood open.

As Barker entered, breathing air which had been admitted when the door opened, a rather blank box, probably a kind of recorder with the lid on, began to speak. There was nothing else in the cell except a box on a plinth, a metallic sheet on the box, and a stylus on top of the sheet.

The recorder said:

"First line: Federation election.

"Second line: Ballot of member worlds.

"Third line: "*Parzel,* followed by space for vote. Vote to be registered by means of a vertical line in the space provided, crossed by an approximately equal horizontal line bisecting it. No other mark to be made.

"Fourth line: *Xyfle,* followed by space for vote. Vote to be registered as already stated.

"Fifth line: *Swampl,* followed by space for vote.

"Sixth line: *Grill,* followed by space for vote.

"Seventh line: *Pentebel,* followed by space for vote.

"Eighth line: *Vas,* followed by space for vote.

"Subsequent lines in small print: Only one vote is permitted. No mark to be made on the voting sheet except the single vote. If any other mark is made, the sheet is invalidated.

"That is all. Repeat. First line: Federation election. Second line: Ballot of . . ."

The recorder chattered on endlessly.

Barker looked at the voting sheet and did not find it difficult to follow. He didn't doubt that what the recorder was telling him was the truth. Probably the Terran vote would not be valid unless the Grillans were able to prove that they had told the Earth people the truth, if not necessarily the whole truth.

It was hardly astonishing that the procedure scarcely differed even in detail from Terran election procedure. What else, after all, could you do? What else was necessary?

All that Barker found difficult to understand was something which the recorded message had not bothered to tell him. How was he to get the sheet in the box? The box did not appear to open and there was no slot.

Experiment soon established the method. The metal sheet, when held at right angles to the top of the box, passed through it easily. Barker nearly lost it. He drew it back hastily. Putting in a blank voting sheet was not part of his plan.

In a moment he had marked the sheet and thrust it into the box. He left the capsule at once, and the door closed behind him. Before he had re-entered the building, the capsule rose slowly and silently, and then with increasing speed.

Pram's rigid face relaxed. "Well, if you'd told me that in the first place," he said, "we needn't have had any disagreement."

"So you approve?"

"Well, it's obvious, isn't it? I'll call the President . . . I don't think he'll have any objection."

Left with Doreen, Barker said: "You don't approve."

She shrugged. "I'm a night-club singer. Nobody asks me when big things are decided. I never expected they would. But I don't understand—just why did you do it that way?"

"Obviously the Grillans are trying to pull a fast one in these elections, yet what they're doing must be legal or it wouldn't be worth trying. So we do have a vote. Naturally, voting is ridiculous when we don't know a thing about any of the six candidate worlds."

"We know something about the Grillans."

"Do we? Who's seen a Grillan? Who's heard one? I think that voice we heard was a speech machine, not a Grillan talking our language."

Doreen shrugged again. "Anyway, why do it that way? It will antagonize the Grillans, and it won't make the rest of these worlds think we're very bright."

"On the contrary. What could we do that would be more intelligent? By registering a vote for all six worlds, including Grill, we may have invalidated the sheet, but we've shown that we fully understand our responsibilities. A vote in ignorance is worthless—only we're so blinded by the virtues of democracy that we don't always remember that.

"Grill can't kick—they'll understand what we did, whether they like it or not. After all, we voted for them as they asked. They didn't tell us not to vote for the other five. Besides—suppose Grill wins. They won't care about our vote. Suppose Grill loses. It'll be up to the winner to ensure that we don't suffer in any way by refusing to vote for Grill."

"There may be a lot of difficulties ahead," Doreen remarked.

"Oh, sure. But there were anyway, the moment any of the Federation worlds made contact with us. All I had to do was make sure we didn't fall flat on our face the moment we got in the door."

On the *Zot*, building up interstellar speed, Fird said: "They've done something. I wonder what?"

For once, Thrum wasn't facetious or contumacious. "It doesn't matter," he said comfortably. "We've got something out of them. And in the time available. What more could we do?"

Fird looked at him with hope, for on the rare occasions when Thrum talked in this way, he could be pretty shrewd.

"We don't have to worry," Thrum said confidently. "If the humans voted for us, our own world will be so pleased with us that they'll protect us from everybody else. If they didn't, then nobody in the Federation has any reason to do anything against us and we'll be famous for making the first contact with the Earth people."

Fird hoped he was right. This was a comforting view of the situation.

Pram had gone and Doreen and Barker were just going. The show was over.

"*Why*," Doreen said, "did women react one way and men another?"

Barker grinned. "Because of you. The Grillans only had time for a snap judgment. They picked your ship and made a quick guess about us based on what they found on board."

"What they found?"

"Feminine things. The only personal things in the ship. The only clues about the human race they had. And what a mistake *that* was."

"Why?"

"However women may holler about sex equality, men will always decide things like what to do when contact with an alien race is made. Right?"

Doreen shrugged. "I guess so. Women have other things to think about."

"As you say. As you said—'Nobody asks me when big things are decided. I never expected they would.' Women's goals are more personal. More Earthbound."

"Maybe, but what did they find on my ship, and why did it put them so far off base?"

"They found what I found when I looked over the ship. A picture of you in a dress that even a member of an alien race could tell was one hundred per cent decorative and zero per cent practical. Costumes and clothes that told them you were only interested in the effect you had on others."

"Well?"

"So they guessed, and guessed right, that humans—they didn't know they were guessing only about feminine humans, and that feminine humans weren't going to decide matters of interstellar politics—weren't self-sufficient, that they liked to lean on someone else, that they were easily influenced through their emotions . . . Hell, I don't know what exactly the Grillans worked out, but I know that it was sound enough—so long as it was only applied to your half of the human race."

"I get it. That's why the appeal worked on us," Doreen murmured.

"Not deeply. Not powerfully. They never learned enough about you for that. Just enough to make you do as they wanted, if it didn't seem to matter much one way or another."

"If women had run the world, I guess Grill would have got the vote they wanted?"

"I guess so. But women don't run the world, in that way. You can't blame the Grillans, though. They must have been sure they were on the right track when they listened to our radio."

"Why?"

"The commercials represent emotional appeals that work. So you can be sure the Grillans listened very carefully to them and did some more guessing. Well . . . Who does most of the spending?"

Doreen laughed. "You're a smart boy. You know too much. I don't think I ought to let you take me out and buy me breakfast—but I will." ■

SYNOPSIS

Telzey Amberdon, fifteen-year-old citizen of the Federation of the Hub and star honor-student at Pehanron College on Orado, returns to Orado from a vacation trip to the primitive world of Jontarou, where an encounter with a telepathic native species has brought her dormant and previously unsuspected psionic talents to life. Fascinated by the experience, she has begun to experiment cautiously with her new abilities.

Unknown to her—and to all but a handful of people—is the fact that the Psychology Service, a formidable and rather mysterious branch of Federation Government, is engaged in a long-term project to bring psionic machines into general use throughout the Hub's interstellar civilization. To further this goal, the Psychology Service is taking whatever measures seem required to prevent popular fears and suspicions about psionics from developing. One of its measures is to keep a controlling hand on the activities of human psis.

On Telzey's arrival at the Orado City space terminal, she is accordingly spotted by a camouflaged psionic machine, identified tenatively as a Class Two psi with definite potential, equipped with a minor unconscious compulsion designed to discourage her from acting in a manner which might create problems for the Psychology Service, and tagged for future occasional observation.

Telzey is unaware of all this until a nightmare brings the planted compulsion into her consciousness. With the help of her father, Gilas Amberdon, executive officer of the Bank of Rienne in Orado City, she begins a survey of what is currently known about psis and psionics, and the survey soon indicates to her that the Psychology Service is the agent responsible for maintaining secret restraints on psis throughout the Hub. The idea of being restrained does not appeal to Telzey, but since the Psychology Service appears to be capable of checking over her thoughts whenever it chooses, she is temporarily baffled by the situation. Then a chance meeting with a telepathic alien leaves her equipped with a very effective mindshield. Concealed behind her shield, she feels the Psychology Service will leave her alone if she is reasonably careful not to draw its attention to her.

At Pehanron College, however, she runs into an unexpected problem. Requested by a close friend, Gonwil Lodis, to find out what has caused the odd behavior of Gonwil's huge dog, Chomir, Telzey investigates the animal's mind one night and discovers indications that Gonwil's distant relatives, the Parlin family, are planning to murder her for her share in Lodis Associates—a thriving financial house on the Hub world of Tayun. Since there is nothing to show how the murder is to be accomplished and Gonwil would never believe such a charge against the Parlins without definite evidence, Telzey does not inform her of her conclusions but flies to Orado City in the morning to get her father's advice and help. Gilas Amberdon, in turn, enlists the services of Wellan Dasinger, the head of a detective agency which has done work for the Bank of Rienne on other occasions.

Part 2

Frontiers tend to develop a rugged and ruthless philosophy.
When half a galaxy is basically frontier—
it develops a thoroughly hard-boiled approach to things!

undercurrents

JAMES SCHMITZ

V

There had been enough general activity during the past two hours to leave Telzey unaware, except for a fleeting moment now and then, that she had begun to feel some physical effects of having lost a night's sleep.

She couldn't, she thought, have complained that her warning wasn't taken seriously! Of course, the fact that Gonwil was a temporary ward of the bank would have required that it be given attention, even without the backing of the personal interest of Rienne's executive officer and his daughter. A query regarding the internal structure of the Tayun concern of Lodis Associates had gone to Transcluster Finance Central almost immediately after her call to Gilas, and she had barely arrived at the bank when a reply came back.

Transcluster's records confirmed in every particular what she had gathered in casual talk with Gonwil from time to time and failed to give its proper significance. Lodis Associates basically had been set up in a manner which tended to leave control of the concern with the founding associates and their heirs. Shares could be sold only after being offered to all other associates at the original value. Since the original value had been approximately a twentieth of the present one, current sales to outsiders were, in effect, blocked. If a deceased associate left no natural heirs, his stock was distributed among the surviving associates in proportion to their holdings.

Which meant that Gonwil's death would, in fact, place the Parlin family in control of the concern . . .

And that seemed enough to convince both Gilas and Wellan Dasinger, the chief of the Kyth Detective Agency, who had arrived before Telzey, that the danger was real. It puzzled her because it hardly looked like conclusive proof of anything, but she decided they were aware of possibilities in situations of that kind which she couldn't know about. Within an hour, the Bank of Rienne and the Kyth Agency had initiated cluster-spanning activities on behalf of the bank's temporary ward which would have stunned Gonwil if she'd been told about them.

So much massive action should have been reassuring. But her father and Dasinger still looked worried; and presently Gilas appeared to realize again that she was around, and explained. It was a delicate situation. As Gonwil's appointed local guardian, the bank could act with a certain amount of authority; but that advantage was based on a technicality which could be shattered in an instant by her guardians on Tayun. "And they're aware, of course—at least in a general way—of Mrs. Parlin's plan."

Telzey gave him a startled look. "Why should . . . "

"Since Gonwil was a minor," Gilas said, "her guardians could have taken legal steps to nullify the condition that her death would benefit the other members of Lodis Associates. And considering that business practices on Tayun remain close to the level of tribal warfare, they *would* have done it—automatically on assuming guardianship—unless it was to their own benefit to be a little negligent about the matter."

"Her own guardians would help Malrue kill Gonwil?" Telzey said incredulously.

ILLUSTRATED BY JOHN SCHOENHERR

"Probably not directly. And of course if Gonwil had decided to marry the son, no one would have had any reason to kill her. But as it stands, we must expect that her guardians will try to hamper any obvious efforts now to protect her against Malrue Parlin. So we have to be very careful not to reveal our suspicions at present. Until we can get Gonwil's formal request to represent her in the matter, we'll be on very shaky legal ground if we're challenged from Tayun. And from what I know of Gonwil, it's going to be difficult for her to accept that she might be in danger from Mrs. Parlin."

Telzey nodded. "We'll almost have to prove it first."

Dasinger put in, "Supposing—this is a theoretical question—this turned into a situation where Miss Lodis saw that in order to stay alive herself it might be necessary to have Mrs. Parlin killed. Knowing her as you do, do you think she could be brought to agree to the action?"

Telzey stared at the detective, realized with some shock that he had been speaking seriously, that it wasn't a theoretical question at all.

She said carefully, "I can't imagine her agreeing to any such thing, Mr. Dasinger! She just isn't a . . . a violent person. I don't think she's ever intentionally hurt anybody."

"And of course," the detective said, "the Parlin family, having known her since her infancy, is quite aware of that."

"Yes . . . I suppose so." It was another disturbing line of thought.

Gilas said quickly, smiling, "Well, we don't intend to let it come to that. In a general way though, Telzey, Gonwil's attitudes are likely to be a handicap here. We'll see how well we can work around them for now."

She didn't answer. There was, of course—as Gilas knew—a way to change Gonwil's attitudes. But it didn't seem necessary to mention that immediately.

Wellan Dasinger, who might be Gilas' junior by seven or eight years, had an easy tone and manner and didn't seem too athletically built. But somehow one gradually got the impression that he was the sort of man who would start off each day with forty push-ups and a cold needle shower as a matter of course. Telzey didn't know what his reaction had been when Gilas told him she's been getting information from the mind of a dog, but he discussed it with her as if it were perfectly normal procedure. Kyth operatives had been dispatched to Beale to look around for the mysterious stranger of Chomir's memories; and Dasinger went over every detail she had obtained, unhurriedly and thoughtfully, then questioned her at length about Gonwil's relationship to the Parlins, the vendetta stories, the maneuvering to get Gonwil married to Junior.

There seemed to be no question of Dasinger's competence. And it was clear he didn't like the situation.

Information began flowing back from Tayun over interstellar transmitters from various contacts of the bank and Dasinger's agency. One item seemed to provide all the evidence needed to indicate that caution was advisable in dealing with the Parlin family. During the past two decades, the number of shareholders in Lodis Associates had diminished by almost fifty per cent. The last three to go had dropped out simultaneously after transferring their holdings to Malrue Parlin, following a disagreement with her on a matter of company policy. Some of the others had taken the same route, but rather more had died in one way and another. There had never been any investigation of the deaths. The remaining associates appeared to be uniformly staunch supporters of Mrs. Parlin's policies.

Dasinger didn't like that either.

"Leaving out crude measures like counterviolence," he told Telzey, "there probably are going to be just two methods to make sure your friend gets a chance to enjoy a normal life span. One of them is to route Mrs. Parlin into Rehabilitation. If she's tamed down, the rest of the clique shouldn't be very dangerous. She's obviously the organizer."

Telzey asked uncertainly, "What's the other method?"

"Have Miss Lodis hand over her stock to Mrs. Parlin for whatever she's willing to pay. I doubt it would be safe to argue too strongly about the price."

Telzey was silent a moment. "Supposing," she said finally, "that Gonwil did agree to . . . well, counterviolence. That would be a private war—"

"Yes, we'd have to register to make it legitimate."

"You . . . your agency . . . handles private wars?"

"Occasionally we'll handle one," Dasinger said. "It depends on the client and the circumstances. I'd say this is such an occasion."

She looked at him. "Isn't that pretty risky work?"

The detective pursed his lips judiciously.

"No, not too risky. It would be expensive and messy. Mrs. Parlin appears to be an old hand at this, but we'd restrict the main action to Orado. If she imported her own talent, they'd be at a severe disadvantage here. And the better local boys wouldn't want any part of it after we got word around that the Kyth Agency was representing the other side. We should have the thing settled, without placing Miss Lodis in jeopardy, in about six months, even if we had to finish up on Tayun. But it appears Miss Lodis has a prejudice against such methods."

"Yes, she does," Telzey said. After a moment, she added, "So do I."

"I don't know about your friend, Miss Amberdon," Dasinger said pleasantly, "but I expect you'll grow out of it. At the moment though, it seems our line should be to try to manipulate Mrs. Parlin into Rehabilitation. We should know inside an hour about how good a chance we'll have to do it. I'm waiting for a call."

The call came in ten minutes later. It was from the Kyth Agency.

There appeared to be much Pehanron's law courses hadn't mentioned about the practical aspects of mind blocks.

The Tayun connection's report to the agency was that the Parlin family had been for years on the official list of those who were provided with mind blocks for general commercial reasons. These, Dasinger explained, were expensive, high-precision jobs which ordinarily did not restrict their possessor in any noticeable way. But when specific levels of stress or fatigue were developed, the block automatically cut in to prevent the divulging of information from the areas it was set to cover.

"You see how it works," Dasinger said. "You have the block installed, have its presence officially confirmed, and have the fact published. Thereafter, nobody who's bothered to check the list will attempt to extort the information from you, because they know you can't give it. The Rehabilitation machines supposedly can take down any block, but they might need a year. Otherwise, nothing I've ever heard of can get much through a solidly installed block . . . continuous questioning, drugs, mind probes, threats, torture, enforced sleeplessness, hypnotics . . . all that can be accomplished is to kill the blocked person eventually, and if that's your goal there're easier ways of going about it."

Apparently, too, the fancier type of block did not bring on the mental deterioration she'd heard about. Malrue Parlin's faculties obviously hadn't been impaired.

"A commercial block of that nature," Gilas said slowly, "presumably would cover plans to murder a business associate for profit in any case." He looked as if he'd bitten into something sour. "When it comes to the Parlins, we can be sure it would cover them. There've been a number of occasions when Mrs. Parlin must have banked on that for protection if an investigation should catch up with her."

"Getting rid of unwanted fellow associates was a business matter, so the block would automatically cover any action to that end," Dasinger agreed.

Gilas rubbed his chin, took out a cigarette, lit it. He scowled absently at Telzey.

"Then circumstantial evidence isn't going to get us anywhere against the lady," he said. "Either in Federation court or in a Transcluster hearing. It's too bad, because in a few hours this morning we've accumulated almost enough evidence to force the Parlins to clear themselves through a subjective probe. After we've sorted it over, we might find we have enough. But a subjective probe would simply confirm that they're equipped with blocks. Tampering with a recognized block is legally equivalent to manslaughter. That would end our case." He looked at the detective. "So what do you suggest?"

"A trap," Dasinger said. "Now, before they find out they're suspected. Later on they wouldn't be likely to fall for it."

"And how do we go about it?"

"My boys are trying to locate Junior. We're not sure he's in Orado City; at any rate, he hasn't checked in at his hotel. But they should have his rooms tapped for view and sound by now, and when they find him, they'll keep watch on him around the clock.

"Two days from now, when his parents arrive, we should be able to have them under observation before they leave the spaceport. There's no reason to think they'll be taking extraordinary precautions at that time, so we should very shortly pick up enough of the conversation between them and Junior to know what their plans are.

"If the plans include the immediate murder of Miss Lodis, we'll go along with it. And with a little luck, we'll catch either the Parlins themselves or somebody who can be proved to be their agent in the actual attempt to commit murder. If they're to wind up in Rehabilitation, we shouldn't try to settle for anything less definite."

He turned to Telzey. "Naturally, Miss Lodis won't be the bait for our trap. We'll have a decoy, someone who can impersonate her to the extent required. But meanwhile we may have a difficult problem in keeping her out of the way without tipping our hand—unless, of course, something can be done immediately to weaken her trust in Mrs. Parlin."

He'd said it very casually. But he might know more about what a psi could accomplish in that direction than he'd indicated. And she could do it. It would take some time; she had found making the initial contact with the mind of a nonpsi human an involved and rather difficult process—something very different from getting into an exchange with other telepaths, and more involved by a good bit than the same proceeding had been with Chomir. But then Gonwil wouldn't realize she was being influenced in any way while her lifelong feelings about Cousin Malrue began to change . . .

Telzey said, "I arranged with Gonwil that we'd start out on a holiday trip together after I get back to college today. We'll take Chomir along. If we can find some place where there isn't too much disturbance—"

Dasinger smiled, nodded. "We'll take care of that."

"Then," Telzey said, "I think I could talk Gonwil into co-operating with us—before Mr. and Mrs. Parlin get here."

"That would be very helpful! And now the dog . . . you mentioned that you should be able to find out exactly why the dog considers that unidentified stranger to be an enemy."

"Yes," Telzey said. Unless she was mistaken, Dasinger had a very fair picture of what she intended to do about Gonwil; and that explained, of course, why he'd accepted her account of Chomir's adventures without question. He did know something about psis. "I think I could get that from him in another couple of hours," she said. "We'd come pretty close to it before I had to stop this morning."

She left the office area a few minutes later to pick up the Cloudsplitter and start back to Pehanron. She had a plan of her own, but it would be best to wait until they had Gonwil under cover somewhere before mentioning it. Gilas mightn't like it; but she'd talk to Dasinger first to find out if it might be feasible to plant her somewhere in the immediate vicinity of the Parlins after they arrived. Gonwil would be co-operating by that time; and while she didn't know whether she could get into a mind that was guarded by a block, it would be worth trying it if she could remain unobserved around Malrue long enough to carry out the preliminary work.

Because if she could do it, they'd do better than find out what the murder plans were. Without knowing why, Malrue would quietly give up her evil intentions towards Gonwil within a few hours, and remain incapable of developing them again or permitting her husband and son to carry on. And that would settle the whole matter in the simplest possible way.

She was approaching the exits to the upper-level parking strip where she had left the Cloudsplitter when somebody addressed her.

"Miss Amberdon! One moment, please!"

It was one of the bank guards. Telzey stopped. "Yes?"

"Mr. Amberdon's secretary notified us just now to watch for you here," the guard explained. "There's an open line to her office in this combooth. She said to tell you a very important matter has come up, and you should hear about it before leaving the building."

Telzey slipped into the booth, frowning. Gilas could have reached her through her wrist-talker while she was in the bank . . . perhaps he didn't want to chance being overheard by some stray beam-tapper. The door closed automatically behind her as she touched the ComWeb's button, and Ravia, Gilas' blue-haired, highly glamorous and highly efficient secretary, appeared in the screen.

"I thought they might still catch you," she said, smiling. "Your father would like to speak to you on a shielded line, Telzey. You're on one now, and I'll connect you with him."

Her image faded. Gilas came on, said briskly, "There you are! There's been a change of schedule. Take your car down to the general parking area. You'll find two of Dasinger's men waiting for you with a carrier. They'll load on your car and take you back to Pehanron with them. We'll brief you on the way."

"What's happened?" she asked, startled.

"We've had a very unpleasant surprise. You'd barely left when two items of information came in. The first was that Mr. and Mrs. Parlin were found listed among the passengers of a ship which berthed at the space terminal something over an hour ago. We're having the Orado City hotels checked, but we don't know where the pair is at present. And Junior hasn't been found yet."

Telzey swallowed.

"Then," Gilas went on, "I had a call from Pehanron College. I'll give you the details on that a little later. What it seems to amount to is that the Parlins have succeeded in creating an atmosphere of alarm and confusion regarding Gonwil's safety, which should serve to keep suspicions turned well away from them if something actually happens to her. One result is that special measures will be needed now to get Gonwil away from Pehanron without dangerous delay. You probably could handle that part of it better than any outsider. Do you want to try it?"

Telzey discovered the hand that rested on the screen button was trembling a little.

"Yes, of course," she said.

"All right." Gilas gave her a brief smile. "I'll tell you the rest of it after you're in the carrier."

The screen went blank.

"And all I've been trying to do all morning," Gonwil exclaimed, somewhere between laughter and dismay, "was to settle down quietly without interruptions to get those grisly Finance Eleven tapes cleaned up! You'd think everybody had gone out of their minds!"

Telzey looked sympathetic. Gonwil's lunch had been delivered to her in the duplex, on Miss Eulate's instructions; and a few college guards in civilian clothes loafed around outside, trying to look as if they'd just happened to wander into the area and weren't really much interested in anything here. Gonwil filled Telzey in on the morning's events while she ate lunch and Telzey thoughtfully sipped a mug of milk. The first thing Malrue Parlin and her husband had done after landing at Orado City's spaceport was to check in at the Tayun Consulate. The first thing the consul general there, an old acquaintance, had done was to tell them about the ominous strangers who had inquired about Gonwil Lodis early in the day. And the fat was in the fire.

"Cousin Malrue went into a howling tizzy!" Gonwil reported, shuddering. "She said she'd always known it was too risky for me to be studying on Orado. So she wanted to get me away from here now, with the Parlin family, where I'd be safe. Naturally, Pehanron said, 'No!'—and am I glad! Old Eulate's bad enough about this, but Malrue . . . !"

"Think she might pop in on you here?"

Gonwil nodded. "The whole family plans to show up at Pehanron this evening. Malrue will be battling with Eulate—and I'll be in the middle! And there's no way I can stop it."

"You wouldn't be in the middle," Telzey observed, "if you weren't here."

"If I weren't . . ." Gonwill glanced sharply over at her, lowered her voice to a whisper. "How . . . when Eulate's got those people staring at my front and back doors? I'm confined to quarters."

"First step," Telzey whispered back, "we move your tapes and stuff to my side. Eulate said under the circumstances it'd be all right if I helped you a little on the tests."

"They can see *your* front and back doors, too, dopey!" Gonwil pointed out. "What good will that do?"

"They can't see inside my carport," Telzey whispered.

"Huh? No!" Gonwill grinned. "The shower window . . ." She looked doubtfully at Chomir. "Can we boost Musclehead through it?"

"We can try. Want to?"

"Ha! When?"

"Right now. Before Eulate realizes you've got a loophole left."

"I should leave her a note," Gonwil remarked. "Something reassuring. I simply *had* to get away for a few days—or suffer a nervous breakdown . . ."

"Sounds fine," Telzey approved.

"Then, perhaps I should call Malrue and tell her, so she . . ."

"Are *you* out of your mind?"

Gonwil looked reluctant. "You're right. Me being at Pehanron is bad, but going off by myself would be worse. If we didn't agree to wait till she could pick us up outside, she'd be perfectly capable of tipping off Eulate!"

Some minutes later, Telzey came out the back door on her side of the bungalow, dressed for a town trip again. The two Pehanron guards stationed across the traffic lane eyed her as she started towards the enclosed carport, but made no move. They hadn't been instructed to keep watch on Telzey.

Inside the stall and out of their sight, she slid behind the Cloudsplitter's hood, roared the main engine experimentally a few times, glanced up. The shower window already stood open. Chomir's big white head appeared in it now, pointed ears tipped questioningly forward, broad brow wrinkled in concentration. He had grasped that something unusual was required of him—but what? To look out of Telzey's shower window?

Telzey beckoned.

"Down here, Brainless!"

She couldn't hear Gonwil's voice above the noise of the engine, but Chomir's air of well-meaning bewilderment increased. Why, his eyes inquired of Telzey, was Gonwil shoving around at his rear? Then his forepaws came into view, resting on the window sill. Telzey gestured violently, pointing at the ground below the window.

Urged on from in front and behind, Chomir suddenly got the picture. He grinned, lolled out his tongue, sank back, came up and out in a flowing, graceful leap, clearing the window frame by a scant half-inch on all sides. He landed and waved his tail cheerfully at Telzey.

She caught his collar and patted him, while Gonwil, red-faced from her effort to lift more than her own weight in dog straight up, came wriggling through the shower window after him with an overnight bag containing the Finance Eleven tapes and her tapewriter. Telzey slid open the Cloudsplitter's luggage compartment.

A minute later, she turned the little car out into the traffic lane. She had barely been able to shove the luggage compartment's door shut on her two passengers; but they were safely out of sight. The two guards stared thoughtfully after the car as it went gliding down the lane. They could hear the music of a newsviewer program within the duplex. It might be a good half-hour before they got the first proddings of suspicion about Telzey and her aircar.

Coming up to the force-screen exit she'd used in the morning, Telzey snapped the Star Honor-Student pass back on her hat. The guards were screening incoming visitors with unusual care today, but students going out were a different matter. They glanced at the pass, at her, waved her through.

As she lifted the car over the crest of the wooded hills north of the college area, a big green airvan veered out of the direction in which it was headed and turned north ahead of her, picking up speed. Fifteen miles on and a few minutes later, Telzey followed the van down to the side of an isolated farm building. En route, there had been a few cautiously questioning knocks from the inside of the luggage compartment, but Telzey ignored them and Gonwil, puzzled, no doubt, about the delay in being let out but trustful as ever, had subsided again.

In the shadow of the farm building, Telzey set the Cloudsplitter down behind the van. Gilas Amberdon clambered out of the front section of the big vehicle and met her beyond hearing range of the luggage compartment.

"Any problems?"

"Not so far," Telzey said. "They're both inside. Has the Kyth Agency found out where the Parlins are?"

"No," Gilas said. "The calls they've made were routed through Orado City but apparently didn't originate there. The chances are they aren't hiding deliberately and will disclose their whereabouts as soon as they hear Gonwil had disappeared from the college."

He studied her a moment. "I realize we're working you a little hard, Telzey. If you take six hours off and catch up on some sleep after we get to the Kyth hideout, it shouldn't make any difference."

She shook her head. "I don't feel particularly tired. And I want to finish up with Chomir. I've got a hunch what he knows will be really important when we get it figured out."

Gilas considered. "All right. Dasinger would like to have that. We'll be there shortly. You'll get separate quarters as you specified—close enough to Gonwil and Chomir to let you work your mental witchcraft on them. And you'll be completely undisturbed."

"That will be fine," Telzey said.

Her father smiled. "Then let's go!"

He started towards the front of the van. Telzey walked back to the Cloudsplitter and slipped into her seat. Half a minute later, the end of the van opened out. She slid the car up and inside and shut off its engines. Benches lined this section of the vehcle. Aside from that, it was empty.

The loading door slammed shut again and the section lights came on overhead. Telzey waited until she felt the van lift creakily into the air. Then she opened the luggage compartment and let her rumpled passengers emerge.

"What in the world," Gonwil inquired bewilderedly, straightening up and staring around as Chomir eased himself muttering out of the Cloudsplitter behind her, "are we doing in this thing?"

"Being scooted off to a safe hiding place," Telzey said. "That was all arranged for in advance."

"Arranged for . . . safe . . ." Gonwil's voice was strained. "Telzey! Whose idea was this?"

"The Bank of Rienne's."

The room they'd put her in here, Gonwil acknowledged, was, though not very large, comfortable and attractively furnished. If, nevertheless, it gave her a somewhat oppressive feeling of being imprisoned, that could be attributed to the fact that it was windowless and lacked means of outside communication.

The only way to leave would be to go through a short corridor and open a door at the far end, which let into an office where a number of people were working. So she couldn't have slipped away unnoticed, but there was no reason to think the people in the office would try to detain her if she did decide to leave. She'd simply been asked to stay here long enough to let the Bank of Rienne determine whether there could be any sinister significance to the appearance of the inquisitive strangers at the Tayun Consulate that morning.

During the brief ride in the airvan, Telzey had explained that the bank felt its investigation would be greatly simplified if it could be carried out in complete secrecy. Pehanron College did not seem a safe place to leave Gonwil if somebody did intend to harm her; and to avoid revealing that it was taking a hand in the matter, the bank had called on Telzey through her father to spirit Gonwil quietly away from the campus.

Allowing for the fact that at the moment everybody appeared obsessed by the notion that Tayun vendettists were after her, it wasn't an unreasonable explanation. The Bank of Rienne did have some grounds to consider itself responsible for her here. "But why," Gonwil had asked, "didn't you tell me all this before we left?"

"Would you have come along if I had?" Telzey said.

Gonwil reflected and admitted that she probably wouldn't have come along. She didn't want to appear ungrateful; and she had now begun to feel the first touches of apprehension. When so many people, including Telzey's eminently practical father, were indicating concern for her safety, the possibility couldn't be denied that there was more to the old vendettist stories than she'd been willing to believe. Cousin Malrue, after all, was no fool; perhaps she had done Malrue an inexcusable injustice in belittling her warnings! Gonwil had only a vague idea of the methods a capable murderer might use to reach his victim; but it was generally accepted that he had a frightening array of weapons to choose from, and that every precaution must be taken in such situations.

At any rate, she was perfectly safe here. The door to the room was locked; she had one key to it, Gilas Amberdon another. She was to let no one but Telzey in, and to make sure that no one else attempted to enter, Chomir was on guard in the corridor outside. It was comfortable to remember now that if Chomir was no shining light when it came to the standard doggy tricks, the protection of a human being was as solidly stamped into his nature as the gory skills of the arena. While he could move, only Gonwil or Telzey would open that door until one of them convinced him he could stop being a watchdog again.

And now she was alone, Gonwil thought, there was something she should take care of promptly.

Opening the overnight bag she had taken from the college, she arranged her study materials on a desk shelf, then brought out the miniature camouflaged communicator which had come with the mail in the morning. She had dropped Junior's unwanted token of affection in with the tapewriter and other items, intending to show it to Telzey later on.

She studied the tiny instrument a moment, pensively biting her lip. There had been no opportunity to tell Telzey about it, so no one here knew she had the thing. The lack of communicators among the room furnishings might mean that they'd rather she didn't send messages outside. But they hadn't said so.

And it seemed only fair to send Malrue a reassuring word through Junior now. There would be no need to mention the Bank of Rienne's investigation. She could tell Junior a very harmless story, one designed only to keep his mother from becoming completely distraught when she heard from Pehanron College that Gonwil had chosen to disappear.

Gonwil glanced back a moment at the door. Then she placed the communicator in the palm of her left hand, and shifted the emerald arrowhead in its cover design a quarter turn to the right. That, according to the instructions which had come with it, made it ready for use. She placed it on the desk shelf, and pressed down with a fingertip on the golden pinhead stud in the center of the cover.

A slender fan of golden light sprang up and out from around the rim of the communicator, trembled, widened, and held steady. It was perhaps three feet across, not much over two high, slightly concave. This was the vision screen.

Now, if she turned the little arrowhead to the third notch, and Junior's communicator was set to receive, he should hear her signal.

She turned it over carefully.

Some ten or twelve seconds passed. Then Rodel Parlin the Twelfth's handsome, narrow face was suddenly there in the fan-shaped golden light screen before her.

"Well, *at last!*" he exclaimed. "I've been trying to call you but . . ."

"I didn't switch it on until just now," Gonwil admitted.

"Busy as all that with your tests?" Junior's gaze shifted past her, went around the room. "What's this?" he inquired. "Did Pehanron actually change your quarters because of the vendettist scare?"

So the Parlins hadn't been told she was gone. Gonwil smiled.

"Pehanron didn't!" she said. "I did. The fuss was getting too much for my nerves, so I sneaked out!"

For a moment, Junior looked startled. "You've left the college?"

"Uh-huh."

"Well, I . . . where are you now?"

"I'm not telling anybody," she said. "I've gone underground, so to speak, and I intend to stay out of sight until the thing blows over."

"Well, uh, Malrue . . ."

"I know. That's why I called the first chance I had. I don't want Malrue to worry unnecessarily, so you tell her I'm in a perfectly safe place. Nobody here knows me, so nobody—including vendettists—can find out where I've gone. Tell Malrue I'm being very careful, and whenever you all decide there's no more danger, I'll come out again."

Junior studied her, frowning doubtfully.

"Malrue," he observed, "isn't going to like that very much!"

"Yes, I . . . just a moment!" Gonwil turned towards the door. Sounds of scratching came from it, then a deep whine. "That's Chomir! He heard us talking, and I'd better let him in before he arouses the neighborhood. It's difficult enough to be inconspicuous with *him* around!"

"I can imagine."

Gonwil unlocked the door and opened it partly, glancing up the hall as Chomir slid through into the room, ears pricked. The door at the far end of the corridor was closed; he hadn't been heard in the office. She locked the door quietly again. Chomir stared for an instant at the image in the viewfield, took a sniff at the air to confirm that while he'd heard Junior's voice, Junior was not physically present. Chomir was familar with the phenomenon of communicator screens and the ghosts that periodically appeared in them. Satisfied, he sat down beside the door.

"I was wondering whether you'd left him behind," Junior remarked as Gonwil came back.

"Oh, I wouldn't do that to Chomir! About Malrue . . ."

He grinned. "I know! She does carry on rather badly at times like this! I'll be tactful in what I tell her."

"Thanks," Gonwil said gratefully. "I wouldn't want her to feel that I'm avoiding her in particular. But would you please *not* tell her about sending me a personal communicator? Say I was just using a regular ComWeb in making this call. Otherwise, she'd want to argue me out of this, and I'd hate to have to refuse her."

"You can depend on me. When will you call again?"

"Sometime early tomorrow?"

"I'll be waiting." He turned his head to the left, appeared to listen. Then he looked back at her.

"I believe I hear Malrue coming," he said quietly. "Good-by, Gonwil!"

" 'By, Junior!"

His face vanished. Still smiling, Gonwil bent over the communicator, searching for the pinhead stud. Junior had been on his best behavior this time; she was very glad she'd decided to make the call.

She pushed down the stud, and the light screen disappeared.

From the far end of the corridor outside came the sound of a violently slammed door.

Startled, Gonwil swung about. Footsteps were pounding up the short corridor now, but she wasn't aware of them. She stood dead-still, staring.

The white shape crouched across the room, ears back and down, huge teeth bared, could hardly be recognized as Chomir. He might have been listening to the approaching steps. But then the snarling head moved. The eyes found Gonwil, and instantly he was coming towards her in a flat, long spring, jaws wide.

As she watched Chomir move off beside Gonwil through the entrance tunnel to the Kyth hideout where the airvan had stopped, Telzey put out a tentative probe towards him.

This time, she was inside the dog's mind at once and so definitely that she could sense him striding along and the touch of the hard flooring beneath his pads. Satisfied, she withdrew. The contacts established during the night's work hadn't faded; she could resume her investigation immediately.

Left alone in the room reserved for her, less than fifty feet from the one to which they had conducted Gonwil, Telzey settled into an armchair and closed her eyes. Chomir still seemed to be moving about, but that made no difference. At this stage, she could work below his awareness without disturbing him or interfering with his activities.

She picked up the familiar memory chains within seconds, and then hesitated. Something had changed here. There was a sense of being drawn quietly, but positively, away from the memories towards another area of mind.

She didn't know what it meant. But since psi seemed sometimes to work independently on problems in which one was involved, this might turn out to be a short cut to the information for which she had been digging throughout the night. Telzey let herself shift in the indicated direction. There was a momentary odd feeling of sinking, then of having made a transition, of being somewhere else.

And it had been a short cut. This was an aspect of mind she hadn't explored before, but it wasn't difficult to understand. A computer's processes might have presented a somewhat similar pattern: impersonal, unaware, enormously detailed and busy. Its universe was the living animal body that generated it, and its function was essentially to see to it that its universe remained physically in good operating condition. As Telzey grasped that, her attention shifted once more—now to a disturbance point in the Chomir universe. Something was wrong there. The body-mind knew it was wrong but was unable to do anything about it.

Telzey studied the disturbance point absorbedly. Suddenly its meaning became clear; and then she knew this was the information she had come to find. And it was very ugly and disturbing information.

She opened her eyes. Her thoughts seemed sluggish, and for some seconds the room looked hazy and blurred about her. Then, as the body-mind patterns faded from her awareness, she discovered she was back in the ordinary sort of contact with Chomir—very clear, strong contact. She had a feeling of catching Gonwil's voice impressions through him.

The voice impressions ended. There was a moment's pause. A sharp surge of uneasiness passed through Chomir.

What did that . . .

Telzey felt the blood drain from her face as she scrambled abruptly out of the chair, reaching for the room communicator. Then her breath caught. She stopped in mid-motion, stood swaying. Electric shivers were racing over her skin. The air seemed to tingle. Psi energy was building up swiftly, oppressively; and she was its focal point.

Fury swept towards her, mindless, elemental, like a roaring wind. She seemed to move, and the room flicked out of existence. Something raged, and about her spun a disk of noise, of shock-distorted faces, of monstrously straining muscles. She moved again, and everything was still and clear.

She was looking into another room, a day-bright room where a man in a yellow suit stood beside a window, studying the small device he held in one hand. Beyond the window, sunlit parkland stretched away in long, rising slopes; and in the far distance, high on the slopes, was the glassy glitter of a familar cluster of buildings.

Something appeared to startle the man. His face turned quickly towards her; and as she registered the details of the sharp features and wispy blond mustache, his eyes became round, white-rimmed holes of intense fright.

The room vanished. Then there was one more sensation, remarkably like being slammed several times on top of the head by a giant fist; and a wave of blackness rolled over Telzey and swept her down.

VI

"Oh, he's admitted it, all right!" Dasinger said, frowning at the solidopic of the man with the thin blond mustache. "In fact, as soon as he was told why he'd been picked up, he became anxious to spill everything he knew. But his confession isn't going to be of much use against the Parlins."

"Why not?" Telzey asked.

"Because one thing he didn't know was who his employers were." The detectives nodded at the tapeviewer he'd put on the table before her. "You can get the details from the report faster than I could give them to you. I have some questions myself, by the way."

"What about, Mr. Dasinger?"

"It seems," Dasinger said, "that when you sensed the dog was turning on Miss Lodis, you did three things almost simultaneously. You pinned the animal down in some manner . . ."

Telzey nodded. "I kept locking his muscles on him. That's what it felt like."

"That's what it looked like," Dasinger agreed. "When we got into the room, he was twisting around on the floor and seemed unable to close his jaws. Even so, he gave us one of the most startling demonstrations of animal athletics I've seen. It was a good half minute before somebody could line up on him long enough to feed him a stunner! Besides keeping Miss Lodis from getting killed in there, you've probably also saved the lives of three or four of my men . . . a detail which the Kyth Agency will remember. Now, as you clamped down on the dog, you also blasted a telepathic warning to your father to let us know Miss Lodis needed immediate help."

"Uh-huh. I didn't realize till afterwards I'd done it."

"Meanwhile again," Dasinger said, indicating the solidopic, "you were putting in a personal appearance in the city of Beale, a good thousand miles away, in the room where this gentleman was operating the instrument which was supposed to be accomplishing the murder of Miss Lodis."

Telzey hesitated, said, "I *seemed* to be there, for just a few moments. He looked scared to death, and I was wondering if he could see me."

"He saw something," the detective said, "and he's described it. The description fits you. The fellow hadn't been told who the intended victim was, and up to that moment he hadn't particularly cared. But his conclusion was that the accusing wraith of the person he'd just helped murder had appeared in the room. That left his nerves in pitiable condition, I'm happy to say, and has made him very easy to handle.

"On the other hand, of course, this experience again limits his usefulness to us. We don't want him to talk about it, because we don't want to start speculations about you personally."

"No, I see."

"I'm assuming," Dasinger went on, "that it was also a rather unusual experience as far as you were concerned. If you could do that kind of thing regularly, you obviously wouldn't need assistance in solving Miss Lodis' problems."

Telzey hesitated. It seemed to her there had been, in that instant, a completely improbable combination of factors, resulting in something like a psychic explosion. The fury pouring out of the dog's mind might have set it off; and she'd been simply involved in it then, doing what she urgently wished to do, but not at all controlling the fact that she was doing it, or how it was done.

It had worked out very well; Gonwil and some other people and Chomir would be dead now if it hadn't happened in just that way. But she wasn't eager for another experience of the kind. The next time it might as easily work out very badly.

She explained it to Dasinger as well as she could. He listened attentively, frowning now and then. At last, he said, "Perhaps you'd better look over the report on Mrs. Parlin's assassin. Then I'll explain what the situation seems to be now."

Whether or not she'd actually gone to Beale in any physical sense during those few seconds, she hadn't relaxed her mental hold on Chomir while she was doing it. And while that had saved lives, it had one drawback. When someone finally poured a stunblast into the big dog, the connection between them was strong enough to transmit echoes of the pounding shock to her brain. It knocked her out, but since she hadn't absorbed the stunner physically the Kyth operatives brought her around again within minutes.

Then, after she'd barely finished giving them the description of the man in Beale, along with the information that Pehanron College could be seen at a certain angle, roughly five miles away, from the window of the room he was in, some well-meaning character slipped her a sedative in a glass of water without stopping to inquire whether she wanted one. Conceivably, she appeared a little feverish and wild-eyed, as who wouldn't, under such circumstances? At any rate, she was unconscious again before she knew what had occurred.

The next time she awoke, eighteen hours had passed and she was in one of the cabins of the spacecruiser maintained by the Bank of Rienne for Gilas Amberdon's use. They were in space, though not far from Orado; she was in bed, and a large woman in a nurse's uniform was sitting next to the bed. The large woman informed her firmly that she would remain in bed until Mr. Amberdon's physician had come out from the planet to examine her again. Telzey, with equal firmness, dismissed the nurse from the cabin, got dressed, and went out to learn what had taken place meanwhile.

In the passage she encoutered Dasinger, looking harried. The Kyth chief told her Gilas and Gonwil were in the communications cabin, involved in a ship-to-planet conference with Rienne's legal department, and offered to bring her up to date.

It appeared that the Kyth operatives dispatched to Beale early yesterday to look for Chomir's menacing stranger had picked up their quarry very shortly after receiving Telzey's description of him and of the area where he could be found. It had been a lucky break; he was on his way to the nearest spaceport by then. They learned his name was Vingarran, that he was a native of Askanam where he had some reputation as a trainer of arena animals; and that he had received an extremely attractive financial offer to come to Orado and apply for work in a high-priced veterinarian establishment in the town of Beale, where he presently would carry out a specific assignment. The vet's was the place where Gonwil left Chomir regularly for his checkup and shots.

In due time, acting on instructions, Vingarran drugged the big dog and planted a device in his brain, of a type sometimes used on Askanam fighting animals when the betting was heavy. Essentially, it was a telecontrolled miniature instrument which produced at will anything from a brief surge of anger to sustained insane fury. Animals so manipulated rarely lost a fight in which they were otherwise evenly matched, and cheating was almost impossible to prove because the instrument dissolved itself after fulfilling its function, leaving only microscopic scars in the brain tissue. After arousing Chomir from his drugged sleep, Vingarran tested his device and found it in good working order.

Some months passed without further action. Then Vingarran received instructions to check the dog's response again at the first available opportunity. He had done this from an aircar while Gonwil and Chomir were on one of their customary hikes in the hills. Following his report that the dog had reacted satisfactorily to minimum stimulus, he was told to wait for a signal which would be his cue to employ the instrument at full output for a period of five minutes, after which it was to be destroyed in the usual manner. This would conclude the services for which he had been hired.

Vingarran had no real doubt that at least one person would be slaughtered by the white hound during those five minutes, that this was calculated murder. But he was being paid well enough to tell himself that what happened when he pushed down the control plunger was not his responsibility but that of his employers. And a few hours later, he would be on his way back to Askanam, and need never hear what the result of his action had been.

The vendettist scare at the Tayun Consulate followed. Professionally, Dasinger regarded it as an unnecessary touch; the authorities investigating Gonwil's death were certain to conclude that her giant pet had gone berserk and destroyed her with the savagery that could be expected of a fierce fighting breed. But the Parlins evidently preferred to have an alternate explanation ready if there were any questions. When Junior established that Gonwil was for the moment alone in a locked room with the dog, the signal was flashed to Vingarran to carry out his orders.

It was a complete picture, except for the unfortunate fact mentioned by Dasinger: the man from Askanam simply did not have the faintest notion who had hired him or from what source his pay had come. He did not know the Parlins, had never seen one of them or heard their voices. He had been told what to do through the impersonal medium of a telewriter. The Kyth Agency would keep him under wraps; but there seemed to be no practical possibility of using him as a witness.

Telzey asked, "Does Malrue know it didn't work . . . that Gonwil didn't get killed or hurt?"

"She knows she couldn't have been hurt seriously enough to incapacitate her," Dasinger said. "She also knows we're aware it was attempted murder, and who was behind it."

"Oh . . . how did she find out?"

"Indirectly, from us. It couldn't very well be avoided. Miss Lodis responded in a very level-headed manner after the situation had been explained to her and she was over the first feeling of shock about it. Junior's call immediately before the dog's attack fitted in too well with the rest of it to let her retain doubts about Mrs. Parlin's guilt. She agreed at once to apply to become the legal ward of the Bank of Rienne. That made it possible for us to act freely on her behalf; but when her guardians on Tayun were notified of the move, it told them, of course, that Mrs. Parlin's plans had miscarried and that they themselves were suspected of complicity. They must have warned the Parlins immediately."

"They didn't argue about the bank becoming Gonwil's guardian?" Telzey asked.

"No. The thing had come into the open, and they realized it. Which is why we're in space. It's one way to make sure Miss Lodis is safe for the moment."

Telzey had a sinking feeling. "For the moment? You don't think the Parlins might give up?"

The detective shook his head. "Not after what we've learned about Mrs. Parlin. She's playing for high stakes here. She's planned for years to get Miss Lodis' share in the company in her hands, and she won't stop now simply because it can't be done quietly any more. It's reasonable to suppose she won't be involved in future murder attempts herself, since that might get her into trouble. But all she has to do is set a high enough price on your friend's head to attract professional sharpshooters. From now on, that's what we'll have to look for."

"But then . . ." Telzey paused. "Then what are we going to do?"

"At present," Dasinger said, "the matter is in the hands of Rienne's attorneys. They'll investigate all legal possibilities. That may take some days. That the Parlins are anticipating moves in that area is indicated by the fact that they're assembled a legal staff of their own. But I don't think they're greatly worried by that approach."

He considered, added, "We'll see what develops. I haven't, of course, suggested to Miss Lodis that we might turn the situation into a registered private war. She's still pretty badly shaken up by the treachery of the Parlin family, and particularly of Mrs. Parlin."

"You're waiting to let her find out there's nothing else she can do?" Telzey asked.

"Perhaps I am," Wellan Dasinger answered thoughtfully.

Telzey shook her head.

"She still won't do it," she said. "Not if it means killing Malrue Parlin."

"It would mean that," Dasinger said. "We might simply frighten the lady into backing off. But it wouldn't settle anything. Miss Lodis would never be safe from her again. Unless, of course, she simply turned her stock over to Mrs. Parlin, on Mrs. Parlin's terms."

"She'd sooner do that," Telzey said. Her skin was crawling.

"Would you like to see it happen?"

"No," Telzey admitted.

"Well, let's let it rest there," Dasinger said. "The lawyers may come up with something. Incidentally, you might see what you can do about Chomir, Miss Amberdon. He's in rather bad shape."

"I thought he was all right again!" Telzey said, startled.

"Oh, the stunner didn't harm him, of course. I'll take you there, and we'll see what you think. If it weren't ridiculous, I'd say he was suffering from a psychotic collapse, brought on by guilt. When Miss Lodis tries to talk to him, he looks away and pretends she isn't there."

Dasinger's diagnosis was accurate enough. Telzey found Chomir lost in a black stew of despondency. His memory of what had occurred after the rage stimulus began to blaze through his brain was a horrid muddle of impressions; but he knew the evil stranger had been nearby in his insubstantial way, and that he, Chomir, had done dreadful things. And the stranger had again escaped. Chomir felt miserably unable to face Gonwil.

It might be possible actually to delete unpleasant memories from a mind, but Telzey hadn't found out how to do it. However, it wasn't difficult to blur out some remembered event until it was barely discernible, and then to shift over other little chunks of memory and imagination from here and there and work them together until, so far as the owner of the mind was concerned, a completely new memory had been created in place of the obscured one.

After about an hour and a half, Chomir wasn't even aware that he had been glooming about something a short while ago. When Gonwil showed up, having heard that Telzey had awakened and was with the dog, he was plainly back to normal behavior.

Other problems, unfortunately, weren't going to be as simple to solve. Gonwil felt that after the first round of conferences with the Bank of Rienne's legal department the lawyers' initial attitude of cautious optimism was beginning to fade. The possibility of bringing charges against the Parlin family in Federation court had been ruled out almost at once. A conviction could be obtained against Vingarran; but not, while their mind blocks protected them from subjective probes, against the Parlins. And there was, of course, no point in prosecuting Vingarran alone. It would be preferable to leave the Parlins unaware for the present of what had happened to their hireling from Askanam.

Rienne's attorneys regarded the prospects of a Trans-cluster Finance ethics hearing as somewhat more promising, though one would have to give detailed consideration to the evidence which might be presented for verification before forming a definite conclusion. If it could be shown in an ethics hearing that the Parlins had planned the murder of a business associate for profit, the results would be almost as satisfactory as a court conviction. Transcluster's adjudicators could not route them through Rehabilitation, but they could order the confiscation of their holdings in Lodis Associates and block them for life from again playing an open role in the Hub's financial world.

The alternative—not infrequently chosen in such cases—was voluntary Rehabilitation. Rienne's attorneys hoped that some connnection could be established between the Parlin family and the death of various other members of Lodis Associates who had been known to be in opposition to them. Added to evidence obtained from the attempted murder of Gonwil Lodis, it might give them a case, though a most difficult one to prepare. The Verifier gave no consideration to probablities and did not evaluate evidence aside from reporting that the mental information made available to it had showed a specific claim to be true or false, or had failed to show either its truth or falsity. Any facts obtained must, therefore, be carefully arranged into a pattern which would condemn the Parlins when confirmed by the mind machine. And that would take time.

The truth of the matter probably was, Telzey thought, that a Verifier or its operators were capable of sizing up the merits of a case almost as soon as an ethics hearing began—if her calculations about the function and potential of the Psychology Service's machines had come anywhere near the mark. But in dealing with them it could make no practical difference, because they wouldn't admit to seeing more than they were supposed to see, even if it meant letting a hearing end in favor of someone like Malrue Parlin. Of course, they couldn't have maintained their big secret otherwise. But it seemed very unlikely that the lawyers were going to dig up something in Malrule's past which could coax a damaging report out of the machine. Malrue would have been as cautious about leaving no direct evidence of earlier murderous activities as she had been in her plans for Gonwil.

The lawyers obviously weren't counting on it either. Another matter they would investigate was the possibility of breaking the clause which effectively prevented Gonwil from selling her stock in Lodis Associates to anyone but another associate. If the Bank of Rienne acquired the stock, it would put an end to Malrue's maneuverings. At the moment, however, it looked as if six or eight years of wrangling in Tayun courts might be required to force a favorable decision on the point.

All in all, Telzey reflected, Dasinger's pessimism was beginning to appear justified. And the mere fact that they were at present confined to the spacecruiser was an intimation of what it could be like to live for years on guard against some unknown assassin's stroke, or hiding somewhere, shut off from normal existence. Dasinger might, as a matter of fact, have arranged the temporary retreat from Orado in part to demonstrate just that.

When they gathered for dinner, she learned that Pehanron College, after being privately briefed by Rienne officials on the current state of affairs, had sent word it was co-operating by placing both Gonwil and Telzey on technical sick leave for as long as might be necessary.

That seemed somehow the most decisive move of the day.

After dinner, she retired early to her cabin. It was possible, as Dasinger had suggested, that the attorneys would still come up with a practical solution. But one clearly couldn't depend on it.

She sent out a thread of thought for Chomir, located him in the cruiser's lounge with Gonwil and Gilas, and slipped back into his mind. It was as easy now as walking into a house to which one owned the key. When shipnight was sounded an hour or so later, she was with him as he followed Gonwil to her cabin. And quite a little later again, she knew Gonwil finally had found troubled sleep.

Telzey withdrew from Chomir and put out the drifting telepathic probe which by and by would touch one of Gonwil's sleeping thoughts and through it establish the first insubstantial bridge between their minds. Then, in a day or two, she would be in control of Gonwil's mental activities, in the same unsuspected and untraceable way and as completely, as she was of Chomir's.

She felt uncomfortable about it. It hadn't disturbed her at all to tap the minds of strangers, just to see what was in there and to experiment a little. Intruding on the private thoughts of a friend, secretly and uninvited, somehow seemed a very different matter.

But the way things appeared to be going made it necessary now.

It was a week before the subject of registering for a private war came up again; and now it wasn't Dasinger's suggestion. The bank's attorneys recommended the move, though with obvious reluctance, to Gilas and Gonwil, as an apparently necessary one if Mrs. Parlin's designs on Gonwil's share in Lodis Associates were to be checked.

By then, nobody, including Gonwil, was really surprised to hear it. It had been a frustrating week for the legal staff. While they felt they weren't at the end of their resources, it was clear that Malrue Parlin had been prepared for years to face a day of reckoning. The investigators on Tayun reported many suspicious circumstances about her activities, but produced no scrap of evidence to connect the Parlins to them. Malrue had few allies with whom she had worked directly; and all of them had protected themselves as carefully as she did.

Other approaches had brought equally negative results.

The rule barring members of Lodis Associates from selling shares to outsiders before their fellows were given an opportunity to purchase them at a prohibitively low price was found to be backed in full by Tayun law. While Gonwil was still a child, the rule could have been set aside with relative ease, but there appeared to be no way around it now that she would be a legally responsible adult within a few months. The minor shareholders in the concern had declined offers of her stock at something approximating its present value, and indicated they would have no interest in it at any price. They clearly didn't intend to get into Malrue Parlin's game.

The Parlins were still on Orado, equipped with a formidable bodyguard and an equally formidable corps of lawyers, both imports from Tayun who evidently had preceded Malrue and her husband here, to be brought into action if needed. But Malrue had made no immediate moves. She might be satisfied to let Gonwil's supporters find out for themselves that her legal position was unassailable.

Telzey had remained a detached observer of these developments, realizing they were running uncomfortably close to Dasinger's predictions. She was giving most of her time to Gonwil. Her previous investigations of human minds had been brief and directed as a rule to specific details, but she felt there was reason to be very careful here.

What was going on inside Gonwil's blond head nowadays wasn't good. Harm had been done, and Telzey was afraid to tamper with the results, to attempt the role of healer. It wasn't a simple matter of patching up a few memories as with Chomir; there was too much she didn't understand. Gonwil would have to do her own healing, at least at the start, and to an extent she was doing it. During the first day or two, her thoughts had a numbed quality to them. Outwardly she acquiesced in everything, was polite, smiled occasionally. But something had been shattered; and she was waiting to see what the people about her would do, how they intended to put all the pieces together again. When she thought of Cousin Malrule's treachery, it was in a puzzled, childish manner.

Then, gradually, she began to understand that the pieces weren't simply going to be put together again now. This ugliness could go on indefinitely, excluding her meanwhile from normal human life.

The realization woke Gonwil up. Until then, most of the details of the situation about her had been blurred and without much meaning. Now she started to look them over carefully, and they became obvious enough.

The efforts of Rienne's lawyers to find a satisfactory solution had begun to bog down because this was a matter which the Federation's laws did not adequately cover. She had been one of the Hub's favored and pampered children but in part that was now the reason she was being forced towards the edge of a no man's land where survival depended on oneself and one's friends. Unless something quite unexpected happened, she, Gonwil, would soon have to decide exactly what the future would be like.

The thought startled her, but she accepted it. There was a boy in the Federation Navy, a cadet, she'd met the previous summer, who played a part in her considerations. So did Telzey, and Dasinger and his agency, and Malrue and her husband and Junior, and the group of professional gunmen they'd brought in from Tayun to be their bodyguards. All of them would be affected in one way or another by what she agreed to. She must be very careful to make no mistake.

Gonwil, seen directly in her reflections and shifts of feeling now that she'd snapped out of the numbed shock, seemed more likable than ever to Telzey. But she didn't like at all what was almost surely coming.

It came. Mainly perhaps for the purpose of having it on record, Rienne's legal department had notified the Parlin's lawyers in Orado City that Miss Lodis desired to dispose of her stock in Lodis Associates. A reply two days later stated that Malrue Parlin, though painfully affected by Miss Lodis' estrangement from herself and her family, was willing to take over the stock. She was not unmindful of her right to purchase at the original value, but would pay twice that, solely to accommodate Miss Lodis.

In Telzey's opinion, the legal department flipped when it read the reply. It had, of course, been putting up with a good deal during the week. It called promptly for a planet-to-ship general conference, and pointed out that the sum Malrue offered was approximately a tenth of the real value of Gonwil's share in the concern. In view of the fact that an attempt to murder Miss Lodis already had been made, Mrs. Parlin's reply must be considered not a bonafide offer but a form of extortion. A threat was implied.

However, Mrs. Parlin might be showing more confidence than she felt. If violence again entered the picture, she was now not invulnerable. To some extent, at least, she was bluffing. To counter the bluff, she should be shown unmistakably that Miss Lodis was determined to defend herself and her interests by whatever means were necessary.

The legal department's advice at this point must be to have Miss Lodis register the fact that against her wishes she had become involved in a private war with the Parlin family, and that she was appointing the Kyth Agency to act as her agent in this affair. The events and investigations of the past week provided more than sufficient grounds for the registration, and its purpose would go beyond making it clear to the Parlins that from now on they would be in jeopardy no less than Miss Lodis. It had been discovered that while the rule which prevented the sale of Lodis Associates stock outside the concern could not be broken in court, it could be rescinded by a two-thirds majority vote of the shareholders, and Miss Lodis and the Parlin family between them controlled more than two thirds of the stock. No doubt, forcible means would be required to persuade the Parlins to agree to the action; but the agreement would be valid if obtained in that manner under the necessities of a registered private war. Miss Lodis could then sell her shares at full value to the Bank of Rienne or a similar institution, which would end the Parlins' efforts to obtain them, and take her out of danger.

Registration, the legal department added, was a serious matter, of course, and Miss Lodis should give it sufficient thought before deciding to sign the application they had prepared. On the other hand, it might be best not to delay more than a day or two. The Parlins' attitude showed she would be safe only so long as they did not know where she was.

"Has she discussed it with you?" Dasinger asked.

Telzey looked at him irritably. Her nerves had been on edge since the conference ended. Things had taken a very unsatisfactory turn. If Malrue Parlin would only drop dead—

She shook her head. "She's been in her room. We haven't talked about it yet."

Dasinger studied her face. "Your father and I," he remarked, "aren't entirely happy about having her register for a private war."

"Why not? I thought you . . ."

He nodded. "I know. But in view of what you said, I've been watching her, and I'm inclined to agree now that she might be too civilized for such methods. It's a pleasant trait, though it's been known to be a suicidal one."

He hesitated, went on. "Aside from that, a private war is simply the only practical answer now. And it would be best to act at once while the Parlin family is together and on Orado. If we wait till they scatter, it will be the devil's own job roping them in again. I think I can guarantee that none of the three will be physically injured. As for Miss Lodis' feelings about it, we—your father and I—assume that your ability to handle emotional disturbances isn't limited to animals."

Telzey shifted uneasily in her chair. Her skull felt tight; she might be getting a headache. She wondered why she didn't tell the detective to stop worrying. Gonwil had found her own solution before the conference was over. She wouldn't authorize a private war for any purpose. No matter how expertly it was handled, somebody was going to get killed when two bands of armed men came into conflict, and she didn't want the responsibiilty for it.

Neither did she want to run and hide for years to keep Malrue from having her killed. The money wasn't worth it.

So the logical answer was to accept Malrue's offer and let her have the stock and control of Lodis Associates. Gonwil could get along very well without it. And she wouldn't have consented to someone's death to keep it.

Gonwil didn't know why she hadn't told them that at the conference, though Telzey did. Gonwil had intended to speak, then suddenly forgot her intention. Another few hours, Telzey had thought, to make sure there wasn't some answer as logical as surrender but more satisfactory. A private war didn't happen to be it.

She realized she'd said something because Dasinger was continuing. Malrue Parlin appeared to have played into their hands through overconfidence . . .

That, Telzey thought, was where they were wrong. The past few days had showed her things about Gonwil which had remained partly unrevealed in two years of friendship. But a shrewd and purposeful observer like Malrue Parlin, knowing Gonwil since her year of birth, would be aware of them.

Gonwil didn't simply have a prejudice against violence; she was incapable of it. Malrue knew it. It would have suited her best if Gonwil died in a manner which didn't look like murder, or at least didn't turn suspicion on the Parlins. But she needn't feel any concern because she had failed in that. The shock of knowing that murder had been tried, of realizing that more of that kind of thing would be necessary if Malrue was to be stopped, would be enough. It wasn't so much fear as revulsion—a need to draw away from the ugly business. Gonwil would give in.

Cousin Malrue hadn't been overconfident. She'd simply known exactly what would happen.

Anger was an uncomfortable thing. Telzey's skin crawled with it. Dasinger asked a question, and she said something which must have made sense because he smiled briefly and nodded, and went on talking. But she didn't remember then what the question had been or what she had replied. For a moment, her vision blurred and the room seemed to rock. It was almost as if she'd heard Malrue Parlin laughing nearby, already savoring her victory, sure she'd placed herself beyond reprisal.

Malrue winning out over Gonwil like that was a thing that couldn't be accepted, and she'd prevented Gonwil from admitting it. But she was unable to do what Gilas and Dasinger expected now: change Gonwil's opinions around until she agreed cheerfully to whatever arrangements they made—and if people got killed during her private war, well, that would be too bad but it had been made inevitable by the Parlins' criminal greed and the Federation's sloppy laws, hadn't it?

It was quite possible to do, but not by changing a few of Gonwil's civilized though unrealistic attitudes. It could be done only by twisting and distorting whatever was Gonwil. And that, of course, wouldn't ever be undone again.

Malrue laughed once more, mocking and triumphant, and it was like pulling a trigger. Dasinger still seemed to be talking somewhere, but the room had shifted and disappeared. She was in a darkness where laughter echoed and black electric gusts swirled heavily around her, looking out at a tall, handsome woman in a group of people. Behind Telzey, something rose swiftly, black and towering like a wave about to break, curving over towards the woman.

Then there was a violent, wrenching effort of some sort.

She was back in her chair, shaking, her face wet with sweat, with a sense of having stopped at the last possible instant. The room swam past her eyes and it seemed, as something she half recalled, that Dasinger had just left, closing the door behind him, still unaware that anything out of the ordinary was going on with Telzey. But she wasn't completely alone. A miniature figure of the Psionic Cop hovered before her face, gesticulating and mouthing inaudible protests. He looked ridiculous, Telzey thought. She made a giggling noise at him, shaking her head, and he vanished.

She got out a handkerchief and dabbed at her face. She felt giddy and weak. Dasinger had noticed nothing, so she hadn't really gone anywhere physically, even for a second or two. Nevertheless, on Orado half a million miles away, Malrue Parlin, laughing and confident in a group of friends or guests, had been only moments from invisible, untraceable death. If that wave of silent energy had reached her, she would have groaned and staggered and fallen, while her companions stared, sensing nothing.

What created the wave? She hadn't done it consciously—but it would be a good thing to remember not to let hot, foggy anger become mixed with a psi impulse again! She wasn't Gonwil, but to put somebody to death in that manner would be rather horrid. And the weakness in her suggested that it mightn't be healthy for the psi who did it, unless he had something like the equipment of that alien in the university's habitat museum.

At any rate, her anger had spent itself now. The necessity of doing something to prevent Gonwil's surrender remained.

And then it occurred to Telzey how it might be done.

She considered a minute or two, and put out a search-thought for Chomir, touched his mind and slipped into it. Groping about briefly, she picked up the artificial memory section she'd installed to cover the disturbing events in the Kyth Agency's hideout.

She had worked the section in rather carefully. Even if Chomir had been a fairly introspective and alert human being, he might very well have accepted it as what had happened. But it wasn't likely that an intruding telepath who studied the section at all closely would be fooled. She certainly wouldn't be. It seemed a practical impossibility to invest artificial memories with the multitudinous, interconnected, coherent detail which characterized actual events. Neither was the buried original memory really buried when one began to search for it. It could be brought out and developed again.

And if such constructions couldn't fool her, could they fool a high-powered psionic mind-reading device, built for the specific purpose of finding out what somebody really thought, believed and remembered . . . such as, for instance, Transcluster Finance's verifying machines?

They couldn't, of course.

Telzey sat still again a while, biting her lip, frowning, mentally checking over a number of things. Then she went to look for Gilas.

"It's a completely outrageous notion!" her father said a short while later, his tone still somewhat incredulous. He glanced over at Dasinger, who had been listening intently, cleared his throat. "However, let's look at it again. You say you can manufacture 'memories' in the dog's mind which can't be distinguished from things he actually remembers?"

"I can't tell any difference," Telzey said. "And I don't see how a Verifier could."

"Possibly it couldn't," Gilas said. "But we don't really know what such a machine is doing."

"Well, we know what it does in an ethics hearing," Telzey said. "Supposing it did see they were fake memories. What would happen?"

Gilas hesitated, said slowly: "The Verifier would report that it had found nothing to show that the Parlins were connected in any way with the attempt to use Chomir to commit murder. It would report nothing else. It can produce relevant evidence, including visual and auditory effects, to substantiate a claim it has accepted. But it can't explain or show why it is rejecting a claim. To do that would violate the conditions under which it operates."

Dasinger said quietly, "That's it. We can't lose anything. And if it works, we'd have them! Vingarran is the only one who can prove the Parlins never came near his device. But we're keeping him out of sight, and the Parlins can't admit they know he exists without damning themselves! And they can't obtain verification for their own claims of innocence . . ."

"Because of their mind blocks!" Gilas concluded. His mouth quirked for an instant; then his face was sober again. "We will, of course, consider every last detail of this scheme from every possible angle before we make a decision. Telzey, go and get Gonwil. We want her in on it, and no one else." He looked at Dasinger. "What will we tell the lawyers?"

Dasinger considered. "That we feel an ethics hearing should be on the record to justify declaring a private war," he said. "They won't like it, of course . . . they know it isn't necessary."

"No," Gilas agreed, "but it's a good enough excuse. And if they set it up for that purpose, it will cover the steps we'll have to take."

VII

"The statements made by this witness have been neither confirmed nor disproved by verification."

The expressionless face of the chief adjudicator of the Transcluster ethics hearing disappeared from the wall screen of the little observer's cubicle before Telzey as he ended his brief announcement. She frowned, turned her right hand over, palm up, glanced at the slender face of the timepiece in the strap of her wrist-talker.

It had taken less than two minutes for Transcluster's verification machine to establish that it could find nothing in the mind of Rodel Parlin the Twelfth relevant to the subject matter it had been instructed to investigate, and to signal this information to the hearing adjudicators. Junior, visible in the Verifier's contact chamber which showed in the far left section of the screen, had not reacted noticeably to the announcement. It could hardly have been a surprise to him. His parents had preceded him individually to the chamber to have their claims of being innocent of homicidal intentions towards Gonwil Lodis submitted to test, with identical results. Only the stereotyped wording of the report indicated in each case that the machine had encountered mental blocks which made verification impossible. From the Parlins' point of view, that was good enough. The burden of proof rested with their accusers; and they simply had no proof. The demand for an ethics hearing had been a bluff, an attempt perhaps to get a better price for Gonwil's capitulation. If so, it had failed.

The central screen view was shifting back to the hexagonal hall where the Verifier was housed. It appeared almost empty. A technician sat at the single control console near the center, while the machine itself was concealed behind the walls. When he brought it into operation, the far end of the hall came alive with a day-bright blur of shifting radiance, darkening to a sullen red glow as he shut the machine off again. So far, that and the reports of the chief adjudicator had been the only evidence of the Verifier's function; and the play of lights might be merely window dressing, designed to make the proceedings more impressive. It had to be that, Telzey thought, if her speculations about the machine were right. It wasn't really being switched on and off here, but working round the clock, absorbing uncensored information constantly from hundreds or thousands of minds, and passing it on.

But watching the hall darken again as the technician turned away from the console and began to talk into a communicator, Telzey acknowledged to herself that she felt a shade less certain now of the purpose for which the Psychology Service was quietly distributing its psionic machines about the Hub. Gilas was in the observation cubicle next to hers, with two of Rienne's attorneys; while Gonwil waited with Dasinger and a few Kyth men in some other section of the great Transcluster finance complex for a summons from the adjudicators to take Chomir to the contact chamber. The hearing had been under way for a little over an hour.

That was the puzzling point. She had come in nervously ready for an indication that the Verifier and the human minds behind it knew what she had been up to before the hearing even began. Her own thoughts were camouflaged; but Gonwil, Gilas and Dasinger were unconsciously broadcasting the information that she was a psi who had manipulated the memories of a hearing witness in a manner calculated to trick the verification machine into making a false report.

While it was the only way left to get at Malrue, the Psychology Service certainly must consider it as flagrant a violation of their rules against the independent use of psionics as could be imagined. But, so far as Telzey could tell, nothing happened then . . . nothing, at any rate, that didn't conform in every detail to what was generally assumed to happen at an ethics hearing. The hearing got off to an unhurried and rather dull start. One of Rienne's attorneys formally presented the general charge against the Parlins—they had planned and attempted to carry out the murder of Gonwil Lodis for financial gain. He brought out background data on Lodis Associates to show the motive, displayed the device used to throw Chomir into a killing rage, explained the purpose for which similar instruments were employed on Askanam. A description of the occurrence in the Kyth Agency's hideout followed, including Gonwil's preceding conversation with Junior by the personalized communicator he had sent her, though naturally excluding Telzey's role in checking the dog's attack until a guard had been able to stun him.

Then the specific charge was made. The Parlins had caused the demonstrated device to be used on the dog at a moment when they could assume it would result in Gonwil Lodis' death, leaving no indication that her death had been planned.

From what Telzey had heard, it was the standard sort of introduction. An ethics hearing developed like a game of skill, unfolding from formalized beginnings, and it wasn't until after a few moves and countermoves had been made that significant revelations could be expected. On this occasion, however, the Parlins' attorneys evidently felt they could afford to skip such cautious preliminaries. It was clear now that Vingarran had been captured before he could leave Orado and had talked; but while he presumably would appear as a witness, nothing he knew could endanger the Parlins' position. The attorneys announced that their three principals denied the charges and wished to testify to their innocence under verification if the commercial mind blocks they employed would permit this.

Having demonstrated then that the mind blocks, as a matter of fact, did not permit it, the Parlins had retired to wait out the rest of the hearing unchallenged.

Which meant that the next witness up should be Chomir.

The use of an animal as a verification witness had been cleared in advance with the adjudicators. It was not without precedent; Chomir would be admitted even if, for some reason, the opposing attorneys objected, and objections weren't expected. The Verifier would be instructed only to establish whether anything could be found in the dog's memory to show the Parlin family had been directly responsible for the murder device planted in his brain.

It was what she had planned. But she had expected to have some intimation by now of what the Verifier's reaction to their doctored witness would be. And there'd been nothing . . .

Telzey leaned forward suddenly and switched off the central screen and voice transmitters. It might still be several minutes before Chomir was taken to the contact chamber. They'd been told he would be doped first to keep him quiet while the machine carried out its work.

She shifted in the chair, laid her hands, palms down, on the armrests, and closed her eyes. The psi bubble about her mind opened. Her awareness expanded out cautiously into the Transcluster complex.

It wasn't quiet there. Psi whispered, murmured, muttered, in an incessant meaningless trickling from the swarms of humanity which crowded the vast Central. But that seemed to be all. The unaware insect buzz of thousands of minds faded, swelled, faded monotonously; and nothing else happened. She could detect no slightest hint of an active telepath, mechanical or human, nearby.

She didn't know what it meant. She opened her eyes again, nerves on edge; and as the psi whisperings receded from her awareness, the side screen showed her Chomir already standing in the contact chamber, looking sleepy and bored. She reached out quickly, switched the center screen back on.

Pitch-blackness appeared before her, gleaming with a suggestion of black glass. After a puzzled instant, Telzey realized she must be looking at the projection field within which the Verifier sometimes produced impressions connected with the search it was conducting. The field hadn't come into action when the Parlins were in the chamber; there had been nothing to show. Its appearance in the screen now indicated the machine had begun its work on the dog.

Too late to stop it; she could give Gilas no plausible reason for interrupting the hearing at this point. She watched the screen, waiting, her hands gripping the chair.

There was a sudden strong impression of somebody looking at her. Automatically, Telzey glanced around at the blank wall of the cubicle. No one was there, but the feeling persisted.

Then she knew Transcluster's Verifier had found her.

Her left hand made a panicky flick to her wrist-talker, jabbed down a tiny button. Why had she imagined it would be similar to a human mind, the mind of any living being? This was like being stared at by the sea. And like a vast, cold sea wave it was coming towards her. The bubble snapped tight.

Ordinarily, it might give only a splinter of its attention to the ethics hearings for which it was supposedly here, and to the relatively unimportant people involved in them; so perhaps it wasn't until this moment that it had become aware some telepathic meddler had been at work on the animal mind it was to investigate . . . and that the meddler was present at the hearing. In any event, it was after the meddler now.

The cold psi wave reached the bubble, rolled over it, receded, came again. An unprotected mind must have been flooded in an instant. As it was, Telzey stayed untouched. It closed over the bubble again, and now it remained.

It might have lasted only for seconds. There was a sense of weight building up, of slow, monstrous pressures, shifting, purposefully applied. Then the pressures relaxed and withdrew.

The machine mind was still there, watching. She had the feeling that others watched through it.

She brought out the thought record she had prepared for them, and flicked the bubble shielding away from it. And if that let them see she had never been so scared in her life, the thought record still spoke for itself.

"Take a good look!" she invited.

Almost instantly, she was alone.

Her eyes fastened, somewhat blurrily, on the projection field in the screen. Colors were boiling up in it. Then there was a jarring sensation of opening alien eyes and looking out from them.

How it was done Telzey couldn't imagine. But she, and presumably everyone else watching the verification field at that moment, was suddenly aware of being inside Chomir's head. There came a reddish flash, then a wave of rage building up swiftly to blazing fury. The fury receded again.

A picture came into being, in glimpsed fragments and scraps of almost nightmarish vividness, of the white-walled room in which Chomir had found himself when he awoke with the microscopic Askanam device freshly inserted in his brain. As he had done then, he was pacing swiftly and irritably about the room, the walls and a semitransparent energy barrier at one end flowing past him in the projection field.

Again came the red flash, followed by the surge of rage. The dog stopped in mid-stride, head swinging towards the barrier. A figure moved vaguely behind the barrier. He hurled himself at it.

The barrier flung him back, once, twice. As he came smashing up against it for the third time, the scene suddenly froze.

At this distance, only inches away, the energy field was completely transparent. Three people stood in the section of the room beyond, Rodel Parlin the Twelfth a few feet ahead of his parents, right hand holding an instrument, a small but readily recognizable one. His thumb was on a plunger of the instrument, pressing it down. All three stared at the dog.

The projection field went blank.

For a second, Telzey had the feeling of somebody's screams echoing through her thoughts. It was gone immediately, so she couldn't be sure. But precisely how Malrue Parlin was reacting to what she had just seen in the Verifier's projection field was obviously of no particular importance now.

Telzey put the tip of her left forefinger on the second of the two little buttons she'd had installed recently in her wrist-talker, and pushed it gently down.

A ComWeb chimed persistently. Half awake, Telzey frowned. She had been dreaming, and there seemed to have been something important about the dream because she was trying to hang on to it. But it faded from her awareness like a puff of thin smoke, and she couldn't recall what it had been. She woke up all the way just as the ComWeb went silent.

And where was she? Couch in the semidark of a big, comfortable room, rustic type, with the smell of pine trees . . . The far wall was a single window and it was night outside. Moving pinpoints of light and a steadier radiance glittered through a pale, ghostly swirling . . .

Tor Heights . . .

Of course! Tor Heights, the mountain sports resort . . . in starshine with a snowstorm moving past. With the hearing over, Gilas had suggested she go ahead with Chomir and rent a cabin here, so she and Gonwil could relax from recent stresses for a few days before returning to Pehanron College. He and Gonwil would stay on until the posthearing arrangements with the Transcluster adjudicators and the Parlins' attorneys had been concluded, and then follow. After she'd secured the cabin and fed Chomir, she found herself getting sleepy and curled up for a nap.

That might have been a couple of hours ago.

As she climbed off the couch, the ComWeb began chiming again in the adjoining room. This time the summons was accompanied by Chomir's attention-requesting rumble. Glancing at her watch, Telzey ran to take the call. She switched on the instrument, and Gonwil's face appeared in the screen, eyes big and sober.

"Hi!" she said. "Your father and I are leaving Draise in about twenty minutes, Telzey. Thought I'd let you know."

"Everything over?" Telzey asked.

"Not quite. They still have a lot of details to settle, but they don't need us around for that. What made it all very simple was that Malrue and Rodel Senior signed up for voluntary rehabilitation, rather than take Transcluster's penalties." She hesitated. "I almost feel sorry for them now."

"Don't be an idiot," Telzey said thoughtfully. "They've had it coming for years."

"I know. But still . . . well, *I* couldn't have done it! Not to keep from losing the money."

Telzey admitted she couldn't have done it either. "What about Junior?"

Gonwil smiled briefly. "He wasn't having any! He told the adjudicators losing his Lodis holdings still would leave him enough to be a playboy the rest of his life, and he couldn't care less about getting placed on Transcluster's black list. The adjudicators said he was practically frothing! Apparently, they were all in a severe state of shock when the hearing ended."

"Glad to hear it," Telzey said. She didn't find herself feeling in the least sorry for the Parlins. "How will you like having Malrue back in Lodis Associates after they let her out of Rehabilitation?"

"I don't know just how I would feel about it," Gonwil said, "but I won't be there when she comes back. That ruling's been canceled, and I'm selling to the Bank of Rienne. I decided I'm not really cut out to be a Tayun financier. Besides, I've . . . oh, started to develop other interests."

"Like in the Federation Navy?" Telzey asked.

Gonwil colored slightly. "Perhaps."

After she had switched off, Telzey found and pushed the button which started the big fireplace in the main room going, then another button which let the sound of the soft, roaring rush of the storm pass through the cabin. She got a glass of milk and sat down reflectively with it before the fire.

Of course, the Parlins had realized they'd lost the hearing as soon as they saw themselves in the projection field. They must have nearly gone out of their minds for a while. But they couldn't prove they'd never been in such a room with Chomir, and to dispute a Verifier's report was useless. What had happened seemed impossible! But they were trapped, and they knew it.

Nevertheless, Telzey thought, it was very unlikely the senior Parlins would have preferred rehabilitation to losing their Lodis stock—if it had been left up to them. That was what had jolted Gonwil: she knew such a decision didn't really go with the kind of people they were. But it couldn't be explained to her, or to anybody else, that the decision hadn't been their own.

Telzey sipped meditatively at her milk. Clear and obvious in the thought record she'd displayed to the Verifier, and to whatever Psychology Service agents were studying her through their machine, was the information that unless a certain thing was done and certain other things were *not* done, vast numbers of copies of a report she'd deposited in an nondirect mailing vault would be dumped into the nondirect system within minutes, tagged with randomly selected delivery dates extending up to fifteen years in the future.

On any day, during that fifteen-year period, there might show up at some of the Hub's more prominent news services a concise statement, with data appended, of every significant fact she had deducted or suspected concerning psis and psionics in the Hub, and particularly of the role the Psychology Service and its psionic machines appeared to be playing. The first such missive to reach its destination should make quite a splash throughout the Hub.

So she'd blackmailed a department of the Overgovernment, and while they mightn't relish it much, frankly, it felt good. Among the things they weren't to do was to try to take control of her, mentally or physically. And the thing to be done, of course, was to see to it that the Parlins were found guilty at the ethics hearing of the crime they'd planned, even though the method of convicting them might be open to question.

Considering the Verifier's ability to scan minds at large, they must have been aware by then that the Parlins were guilty, though they wouldn't have lifted a finger to help out Gonwil if they hadn't been forced to it. Being forced to it, they turned in a fast, artistic job, using Telzey's fabrication but adding a number of lifelike touches she couldn't have provided, and presenting it in a convincing dramatic manner.

Then they'd had to take immediate additional action to keep the stunned Parlins from wailing loudly enough to raise doubts about the infallibility of the ethics hearing procedures. As she knew from experience, the psionic machies were very good at installing on-the-spot compulsions.

So Malrue and her husband had applied for rehabilitation. The machines in the rehabilitation center would take it from there. The Psychology Service might have exempted Junior as being too much of a lightweight to worry about, but they certainly had seen to it that he wouldn't do any talking.

So far, so good, Telzey thought. She put down the glass of milk and slipped off her shoes. Chomir had strolled in from the next room and settled himself in front of her, and she placed her feet on his back now, kneading the thick, hard slabs of muscle with toes and heels. He grunted comfortably.

Gonwil's difficulties were over. And now where did she stand with the Psychology Service?

She considered it a while. Essentially, they seemed to be practical people, so they shouldn't be inclined to hold grudges. But she would look like a problem to them.

She'd reduced the problem as much as possible. Letting somebody look into sections of your mind was a good deal more satisfactory than making promises when you were out to create an atmosphere of confidence. If they could see what you really intended, they didn't worry about cheating.

The Psychology Service knew now she wouldn't give away any of their secrets unless they forced her to it—which again was a practical decision on her part. She couldn't talk about them to Gonwil or her parents or Dasinger because their minds would be an open book any time they came near a psionic machine, and if she had told them too much, they might be in trouble then.

And in her own interest, she had no intention of telling people in general what she knew about psis—not, at least, until she understood a great deal more of what she'd be talking about.

Again, so far, so good.

Then there was the matter of having threatened to use the nondirect mailing system to expose them. She hadn't let them see whether she intended to give up that arrangement or not. As a matter of fact, the package of prepared reports had been destroyed shortly before she set off for Tor Heights, because of the risk of something going wrong accidentally and, not inconceivably, changing the course of Federation history as a result. They probably had expected her to do it, but they couldn't be sure. And even if they were, they didn't know what else she might have cooked up.

So the probability was they would decide it was wisest to leave her alone as long as she didn't disturb their plans. For her part, she would be very happy to leave them alone providing they didn't start trying to run her life again. No doubt, they could have taught her what she wanted to know about psionics; but their price looked like more than she was willing to pay. And she didn't seem to be doing too badly at teaching herself.

The Federation of the Hub was a vast area, after all. Aside from occasional contacts with their mechanized spy network, there was no real reason, Telzey concluded, why she and the Psychology Service should ever run into each other again.

Satisfied, she reached around for a couch cushion, placed it behind her neck, wriggled into a different position, laid her head back and closed her eyes. Might as well go on napping until Gilas and Gonwil arrived. On checking in here, she'd been told that float-ski conditions were perfect, so tomorrow should be a quite strenuous day . . .

Abruptly, she found herself sitting bolt upright again, eyes wide open, while Chomir grumbled at her feet about all this shifting around.

She had drifted straight back into the dream out of which the ComWeb had roused her twenty minutes before. It had been another dream about the Psionic Cop. He'd appeared almost completely faded out, hardly more than a transparent outline of what he'd been; and Telzey had informed him, perhaps a trifle smugly, that he might just as well vanish for good now. Since she'd let the Psychology Service know she could block out snoopers, there was no further point in his hanging around her.

And the ghostly Cop had nodded very seriously, and said, "Yes, we were greatly pleased to discover you had been able to develop such an effective defensive measure, Miss Amberdon! It was one of the things we had to find out about you. You see, it will be necessary . . ."

Telzey bit her lip uneasily, staring at the quietly dancing fire, listening to the soft moan of the snow winds over Tor Heights. An eerie little chill began to slide up and down her spine.

It has been just a dream—probably! It didn't have to mean anything.

But supposing it hadn't been just a dream . . .

Necessary—*what?* ■

MUSTN'T TOUCH

So Mankind finally achieved the Star-Drive;
his ships could go to the ends of the Universe at last!
But . . . there was one slight hitch . . .
the price was so high no man could go . . .

POUL ANDERSON

Illustrated by Michael Arndt

There got to be too much knowledge; and more kept pouring in. The fusion of disciplines helped for a while. But soon a biophysicist, say, found his head so full of quantum mechanics and advanced stochastics that he couldn't follow the newest revisions of unified field theory, though he knew in a vague way that eventually some aspects were bound to impinge on his own work. Cybernetic information retrieval made anything quickly available to him—but how could he know just what to look up? The development of creatively synthesizing robot brains—a poor term, but "computer" is even less accurate—was helpful; nevertheless, their own capacity, while large, was finite, and in any case a man had to decide what assignment to give them. He couldn't always be sure, or even guess what general type of problem he ought to foresee.

The story goes that in the very earliest days of astronautics, an engineer in a manned-capsule project asked the physiologist on the team how much dissolved material it was necessary to remove from urine in order to reclaim potable water. "All of it," the physiologist replied, "if you want to stay friends with your astronaut." Raise that communication barrier by several orders of magnitude, and you will appreciate the dilemma that evolved.

Until one day—

Luna had fallen behind. The forward viewscreens held only blackness and stars. Job moved through space like a whale through the sea, as quietly and smoothly. There was no sound in Emil Eide's cabin other than the hum of a ventilator, the occasional clicking of a switch or relay. Acceleration pressed him into his seat, so gently that he felt buoyant, almost young again.

But his eyes were tired. He racked away the copy of *Scientific American* he had been studying. It was dated several years ago, he had read the lead article before, had simply wanted to refresh his memory. Not that it could tell him much. The magazine had tried valiantly to give a responsible account of the theory behind faster-than-light drive, but you had to be a matrix physicist really to understand.

He rubbed his eyes and rested them with a long look at infinity. So many were the ice-sharp points of light out there that the constellations were drowned. Not to him, of course, with the experience of his youth to guide him. Even after three decades Earthside, he could pick out Orion and the Hounds, the Wain and the Dragon. But it came back to him, suddenly and startlingly, that each of those stars was a sun.

When the ships began to fare yonder, soon now— A couple of lines ran through his head.

Bliss was it in that dawn to be alive,
But to be young was very heaven!

Well, he thought, he had had his own dawn. Noontime, anyhow, while the last bodies in the Solar System that could possibly be colonized were being made ready. His work hadn't been entirely in the lab, either, on the biotechnic problems. Shorthanded as the crews were, he'd often been out with a bullmole; and the preliminary surveys had involved some rough expeditions. There was a sense of fellowship at the end of such a day, the like of which could no longer be found on poor crowded Earth.

To strike out afoot beneath a new sun, clean air and a living landscape— *Ah, stop sniveling, you old idiot. You can always listen to the stories the young men bring back. Besides, you've been handed a share in the enterprise, right here and now.*

He felt an obscure guilt about that. Dow's unexpected death was the reason why Oslo University's professor of bionics had been co-opted into Project Cosmos. Experts in that particular field were so rare, and there was so much eagerness to go ahead with the work, that Eide's briefings were short and he had boarded Job with less information than he really ought to have had. *Well, Dow, you were a good man, God rest you—*

He got out his pipe and stuffed it with fingers that were still scarred and big-knuckled. "Job," he said aloud.

"Yes?" said the ship.

"Are you too busy to talk?"

"No." The voice from the cabin speaker had inflections, but no real tone like a man's. There was a faint brazen ring to it. "This is an entirely routine interception curve."

"When will we get there?"

"We will have matched velocities and made contact in another eighteen minutes. Loading the probe aboard should take less than ten minutes. But as for the various tests to be made, at present there is insufficient data for prediction."

The flatness irritated Eide. "Damnation, aren't you excited at all?" he grumbled. "I could wonder if transistors and mesoducers and the rest of robot circuitry ever feel any emotion— No, don't comment." His annoyance faded out. "I'm well aware that an emotion is the perception of a drive in action, and you have drives. Just not my kind. What I really wonder is how it feels to be you."

"There is an extensive literature on robopsychology," Job said.

"I know. I've read some. All behavioristic. No use to me."

"Technically your statement is incorrect."

"Never mind technicalities. Behaviorism is what it amounts to. Pure description, from the outside only. We can't get inside our own creations." Eide noticed that his pipe was yet unlit, and flicked a torchie to its bowl. "Ah, well," he said, "I daresay you feel the same way about me, if you ever bother to wonder. And is that intrinsically any different from the way my children and I felt about each other, when they were growing up? There was always a strangeness between us, no matter how much we wanted to bridge it."

Job did not answer. Eide sighed. He'd been attempting to make amends for his outburst. When he remembered, he tried harder than the average person to treat robots courteously. After all, they were rational, conscious beings. However often he was told that they didn't mind their situation, that it was perfectly satisfactory to them—in so far as "satisfactory," or any human-emotional word, meant anything in that connection—he could not quite get rid of an uneasy feeling that he was a slave-master. But his attitude never seemed to affect their responses to him, one way or another.

"Well," he said inanely, "I think I'll go forward." He rose, a short, thick, gnarly man, face gnomish under a ruff of gray hair, clothes a trifle rumpled and shabby. Job opened the cabin door for him and he moved along the corridor with the dreamlike ease of low-weight.

Bill Villiers and Dave Urban, the Australians, were seated with spaceman's bombillas of tea in the main observation verandah. Besides Eide, they were the only men aboard. And none were really needed. The laboratory ship could do everything, recover the probe, transcribe data from the instruments, observe and dissect and analyze the living specimens, draw conclusions, prepare a formal report, with electronic speed. But it wasn't psychologically possible for the people at Cosmos' Lunar base to send no representatives. Their presence was justified on the grounds that something unforeseen might arise and men would be needed to make quick executive decisions. Eide suspected that was mere rationalization.

Nonetheless he was glad, with a deep quiet happiness, to be here.

"Hullo, cobber," said Villiers. "Come to watch the show at last?" He was an assistant director of the engineering section, a long lean man given to loud shirts and baggy trousers. "You do take your work seriously." He told the servitor to bring another bombilla.

"Doesn't everyone?" Eide replied, finding a seat for himself. "I know there has been much public complaint at the slowness of progress, but I think Canberra appointed a crew of beavers. Colbert's equations were published only ten years ago, Otway made the first experimental demonstrations three years later, and in a bare five years of work on Luna, you have produced FTL probes. Whoof!"

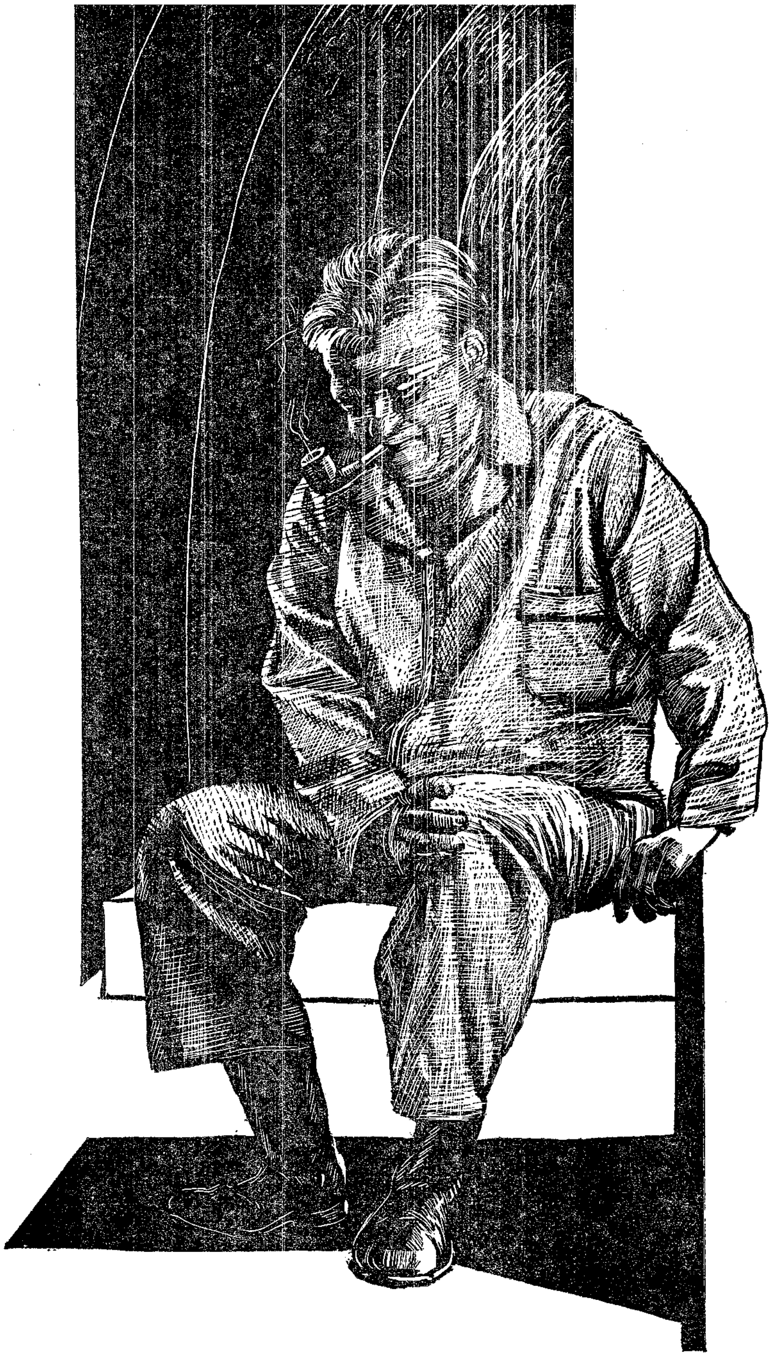
Villiers chuckled. "Actually," he said, "Otway could have made his breakthrough far sooner, if he'd known about Huang's theory of the relationship of hyperons and gravity currents. But the connection between that and Colbert's equations wasn't obvious enough."

Eide laughed back. "How familiar that sounds! I wasted sixteen months once, working on the genetic code, finding out what I was after in the hardest possible way. And all the time my results were implicit in the Wavicle Theorem—as several biophysicists pointed out with glee as soon as I had published."

"Genetic code?" Urban, medium-sized and blond, looked surprised. He was a biologist himself, though his competence was elsewhere than the submolar level on which Eide worked. "But that was cracked more than a century ago."

"This was a question about its nature," the Norwegian said. "Almost a philosophical question, though the answer is empirically verifiable. You see, it's been known for a long time that the code is the same for every form of life. So either it's not subject to mutation—which doesn't make sense—or there are certain constraints on how an amino acid can pair with a codon on an RNA molecule. But in the latter case, what are the constraints? Well, that's equivalent to asking how the code-reading mechanism works, not just in a chemical sense but as a function of natural law."

Urban shook his head and clicked his tongue. "Fascinating. I never knew before, and I thought I kept up with the field rather well. Just goes to show you, eh?" He paused. "Er . . . wait a bit. D' you mean that life everywhere in the universe has to use the same code?"



"N-no. We aren't sure about that. I suspect not, but we don't know what the permissible variations are. That's one of the things I hope your starships will come back and tell us."

"Yeih," Villiers drawled. "Which is why the scientists have been on the Authority's back, wanting the project hurried beyond all reason. Impatient to know. There was quite a tussle last year, when we were readying the first instrumented probes. One faction wanted them sent immediately to the nearer stars. We resisted, though. Haste makes waste. We're still a long ways from itemizing every property of warped space."

"Besides," Urban added, "unmanned probes can furnish just enough information to tantalize the hell out of us. We'll send them in advance of the first manned expeditions, naturally—but the men are what we're really counting on."

"And who are counting on you," Eide said quietly.

Villiers blinked. "What? Oh, you mean colonization."

"Well, yes, in part." Eide's mind went back to Earth: too many people, no more wilderness, no escape from your fellow man, individuality strangling in an unavoidable web of law and regulation. Crowding wouldn't increase forever, probably. Put rats in a cage and let them reproduce for a while. Though you feed them well, the overpopulation soon makes them so neurotic that their breeding rate nosedives. He didn't like to think of his grandchildren growing up misanthropic agoraphobes.

As an alternative, you could put the brakes on in time, reduce the numbers of mankind step by step to a reasonable level, finally stabilize birth and death . . . what a fine, manicured, smug, ingrown future that was!

He struck the bulkhead with a balled fist. Urban started at the thud. "This project will succeed," Eide said, "because it's got to."

"I say, you really do itch for adventure, don't you?" Villiers remarked. "Myself, I'm content to stay in the lab."

"I'm too old to go," Eide shrugged. "But my youngest son, he's the sort that really ought to have shipped out with Leif Erikson. And he's not unique."

"I know," Urban said. "Canberra is counting heavily on us. Not that interstellar emigration can reduce population pressure much at home; but social pressure, restlessness and discontent, that's something else again. Especially when we start feeling the impact of new knowledge about the universe. Bound to have strong effects on society, both direct and indirect."

Eide reached for his bombilla, which the servitor had been patiently holding out to him. He forgot it when Villiers yelled: "Look! There she is!"

The shape grew rapidly in the viewscreen, sharp across the Milky Way. Sunlight dazzled off its slender flank. There went a primitive tingle along Eide's nerves. That object had carried the first living creatures ever to go faster than light, from this orbit to Neptune's and back, in less than one minute.

The seat took a firm grip on him and Job shifted acceleration. The probe need not have waited this hour for rendezvous to be made. Its point of return was closely predictable. But the laboratory ship stood a ways off as a routine precaution. Warped space was an eerily new thing to deal with. There were even some cranks who preached that changing the constants of physics was a direct defiance of God. Well, they had said much the same about every fundamental advance; and people did in fact get hurt, by fire and domestic animals and steam engines and fusing atoms. Few physicists completely understood the Colbert-Otway Effect. There was too much else they had to understand.

The probe slipped out of sight as Job lay alongside. Acceleration ended. Villiers popped an anti-nausea pill into his mouth, but free fall didn't seem to bother Urban and Eide enjoyed it. The view flickered briefly: induced currents when the radiation screens of the two craft interacted. It steadied again. A quivering sounded through the hull, a series of clanks and a long rumble. Then silence drew a curtain between men and ship.

"Probe taken aboard," Job said at length. "If there are no contrary orders, I shall proceed at one-tenth gravity toward Luna. Weight will be useful in carrying out analyses, and that acceleration should allow ample time for the most important preliminary ones."

"Right-o," Villiers said.

The engine purred. Eide's body sank back into the seat cushions. He felt himself released, and bounced up. "Let's go!"

"Where?" Villiers asked.

"Doctrine is that no human shall approach the probe until I have verified that it is safe to do so," Job reminded them.

Urban grimaced. "Yes, yes, yes," he muttered. "But you needn't be so cold-blooded about it. You tin brains give me the willies sometimes."

"Oh, do relax," Villiers said. "Why should he be emotionally concerned? This isn't his daydream."

Eide felt embarrassed. Job was listening. It occurred to him that Ultra Model Electroencephalon Mark IV, serial number such-and-such, was all too well nicknamed.

Villiers took a thoughtful drag at his bombilla. "Y' know," he went on, obviously trying to calm down the biologists—he was sure that the engineering aspect was O.K.—"we've talked for a long time now about making contact with alien races. But I wonder if we'll ever find any as alien as this one we've built ourselves."

"That's beside the point," Eide said. His own purpose was to change the subject. "What we'll gain from extraterrestrial civilizations, besides knowledge, is culture. New insights, new arts, new philosophies, new ways of living. We're getting stagnant now. I say nothing against the Australian Authority—war had to be eliminated somehow—but it isn't enough. Not if we wish to keep mental as well as physical frontiers."

Urban gnawed a knuckle, but managed to say, "True. Another reason, by the way, Eide, why we haven't sent probes to the stars yet. It'd delay development of a manned FTL ship. To understand what those races are about, what their cultures mean, we've got to have people actually living there, getting to know the intimate details, learning to think in extrahuman ways. Otherwise we'll just be collecting a slew of inferior travelogues."

"There's that," Villiers said. "Also, even in purely physical science, the fact is that instruments can only experience what they're designed to experience. You need a conscious being on hand, a being with imagination, who can see something totally unexpected and come back to describe—" Abruptly his own calm broke across. He set his bombilla down on the table so hard that it rattled. "What are we bandying cliches for?" he growled. "Hurry up, will you?"

"I have begun chemical tests," Job said. "But you must allow me some time yet to make certain that the environment is safe for you."

"*Hvad?*" Eide exclaimed. Fingers closed around his heart.

"The bacterial and protozoan cultures are dead. The higher plants and metazoans are dying."

The operations hold was vast and dim, but so crowded with instruments that men must walk carefully. Eide passed by a thing of tendrils and tubes which under Job's direction was placing a slide in an electron microscope. Just beyond, a centrifuge whirred, and colors crawled up a chromatograph. The fluorescent illumination felt cold on his skin.

The probe lay long and shining in its rack. One side was open and the biological specimens, such as had not been removed so far, were exposed to view. Urban had snatched a sample of algae, turned to brown scum in the past couple of hours, and put it under a microscope of his own. Eide brushed aside a pumpkin leaf—green and unwithered, but the needle on an attached biometer stood at zero—to look at a cageful of rats. Most lay unmoving. A couple of them still panted feebly. Even as Eide watched, one crawled to a water dispenser and drank again. Its belly was bloated. After a moment it gasped, shivered, and fell quiet.

A machine arm reached over Eide's shoulder, opened the cage, and hooked the body out. Wheels trundled. Turning, the bionicist saw the small furry shape popped into a revival chamber. A heart-lung device began to chug. His gaze went back to the other corpses. "You poor dumb devils," he murmured.

Villiers came to stand beside him. The engineer's face was locked into grimness. "I just checked the instrument records for myself," he said. "There is no difference from the probes we sent before. No difference whatsoever."

"Radiation?" Eide groped.

"No. That would have registered. Anything physical known to man would have."

"I thought . . . perhaps . . . when you go blasting through the hydrogen in space, faster than light—"

"Those atoms don't penetrate the drive field. The warp is equivalent to too great a potential barrier. You do get aerodynamic effects, which you have to allow for in plotting an orbit. But nothing from the outside universe can directly affect what happens inside the hull." Villiers jammed hands in pockets. "I also made a quick check of the power and pilot systems. As far as I went, it only confirmed Job's word that they functioned normally the whole time."

Urban joined them. "I can't find any structural alteration in the cells," he said. His voice fell flatly amidst the hummings and buzzings. "Oh, certain gross pathologies, but no clue to what produced them, nothing like the changes in structure that a virus makes, say. Well, Job will have to investigate the submolar details. He's doing that now . . . The beast is doing *everything*."

"That's what he is for," Eide said.

"But . . . our own helplessness!"

"We're no use here," Villiers said. "Let's go back."

"And keep on talking in circles?" Urban groaned.

"Not necessarily," Eide answered. "We should start getting some data to work with pretty soon." His feet dragged over the deck.

Job's voice pursued him: "Revival procedures have failed."

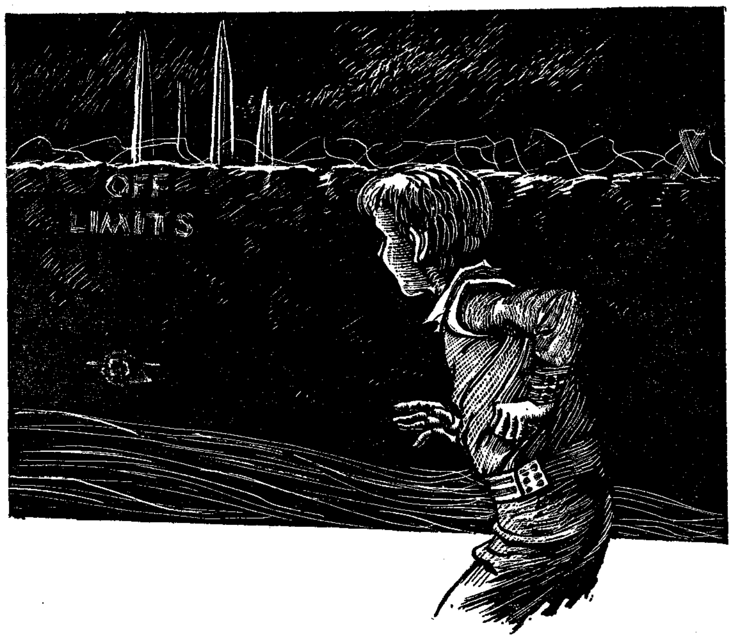
"What about the specimens in cold sleep?" Urban demanded.

"What's this?" Eide asked.

"Didn't you know?" Urban said. "We wanted to test that, too. Knocked 'em down close to absolute zero, at the usual speed with the usual drugs. The idea was that spaceship crews should have the equipment available in case of medical emergencies. Maybe cold sleep has inhibited whatever chemical change went on here."

"Come on," Villiers said. "Let's get cracking."

They went topside at a funeral pace and settled back into the verandah seats. Space blazed at them. The pockmarks on Luna were becoming visible.



"Well." Villiers lit a cigarette and drew a ragged puff into his lungs. "What about some tea?"

Eide looked straight at Sirius. *We're coming just the same,* he told it. He shook his shoulders and willed determination into himself.

"This seems to be in your line," Urban said to him tonelessly. "No apparent changes in cell structure. So what happened at a more basic level?"

Eide frowned, gathering his wits. "You must help me there," he said. "I have tried to understand how the spacewarper works, but I couldn't get much through this thick old noggin. What part of its operation might have biological effects?"

"Who knows?" Villiers said. "Theoretically, though, there shouldn't be any important ones."

"What about the minor ones? They may not be so little after all."

"Well, of course the alteration of natural constants is bound to have some influence on the chemistry and physics of an organism."

"Tell me very simply, please, how that works. I think I know, but I need to be sure."

"Tell you without math? Can't." Villiers recollected himself. "Sorry. You must have a fair background in math, for your own work." He reached for a notepad in his shirt pocket. "Uh, the equations—"

"No, no. I've seen them. What I mean is something like this. In modern physics, the laws of nature can be expressed as functions of space-time geometry. For instance, the frequency of emitted light, or of atomic vibration, is affected by the gravitational field, which in turn depends on—or is—the local warping of space. Likewise, the exact form of a particle's psi function, its probability-wave, is conditioned by geometry, by just what curve is locally a geodesic. Now the Colbert-Otway Effect involves the creation of some very peculiar warps indeed. Within the drive field of one of your interstellar probes, light has a different velocity and the mass-energy relationship takes on a new form. Thus speed is no longer limited by the velocity of light in 'flat' space. Am I correct?"

"You're not too far off," Villiers nodded.

"O.K., then, why does this not change the other constants of nature so much that nothing will work?"

"Because there are compensating effects. If one parameter, like dielectric constant, increases, a related one tends to decrease. And the warp is a good bit weaker inside the drive field than at the edge. Oh, we've had our problems. A Nicad battery rated at 1.35 volts delivers 1.42 while the probe is traveling. Photofilm sensitivity drops from ASA 1200 to 970. That sort of thing. We had to design a tandem autocontrol, one set of computers to operate under normal drive, another under FTL. But each can feed its data directly into the other, so this still amounts to having only one system, using its 'right' or 'left' half as the need arises. It works fine, now."

"Ah," Eide pounced. "But biological systems are much more complicated—chemically, at least—than anything robotic."

As if on cue, Job said: "Analysis shows certain trace compounds in the cells studied. They are proteins, but do not appear to be identical with any described in my memory banks. It will take considerable time to establish their molecular structure. Do you wish me to defer that and proceed at once with the examination of the cold sleep specimens?"

"Yes, yes," Urban almost shouted.

"Wait," Eide said. Excitement fluttered in him. "How much of those proteins is there, quantitatively?"

"Microquantities," Job answered. "I do not know how they were synthesized, but they do not appear sufficient to cause mortality, even if they are poisonous."

"Haven't you found anything else?"

"Further data on observed pathologies. You saw how thirsty the rats were, and how this led to edema. I am tracing out the chemistry of that metabolic imbalance. There appears to be some enzymatic abnormality involved. A full description will be prepared in due course." After a moment: "Despite every effort at treatment, the last metazoan has just died."

"Wasn't there any way to save them?" Villiers asked. His words came harsh and uneven.

Urban spoke an obscenity. "No," he said. "This ship has every kind of apparatus. The Prime Minister couldn't have gotten better care than those wretched animals."

Eide gloomed at the deck. "Let us get back to, um, the background," he said. "Could it simply be that no organism can survive the changes in physical constants under FTL? If, for instance, the rate at which neurones fire, or the oxygen tension, or any such thing, is altered too much—the organism dies."

"But the change isn't that great," Urban replied. "We made plenty of preliminary experiments, believe me. To take your own example, we reduced neural rates and oxygen tension, with drugs, away below what FTL would do; not to speak of pH, osmotic pressure, everything we could think of. No harm. Oh, on a prolonged trip there'd have to be certain precautions. Special diets and so forth. But no trip would be too long. In warped space, transit time between stars is only a few hours. The crew's health should be less affected than it was by weightlessness in the early days."

"And yet," Villiers breathed, "everything on the probe was effectively killed, within sixty seconds."

Eide lifted his eyes to the viewscreen once more Earth gleamed at one edge. The sun was just rising over Europe.

"Wait a minute!" he said. "Clearly, under the conditions of FTL, some fundamental biological mechanism is deranged. The question is what, and what can we do about it? Now look, suppose some important molecules break up, or simply flip over into a different isomer—"

Urban shook his head violently. "No. We thought of that long ago, and checked it out. Impossible. The changes in relative energy potentials and so forth aren't enough to break any chemical bond that matters. Certainly not enough to alter atomic nuclei. My team even looked into the possibility of ordinarily random hookups acquiring a directedness, so that lethal compounds could be formed. It turned out to be a statistical absurdity." He raised his voice. "What's new, Job?"

"Configurational analysis has now been performed on several individual chromosomes," the ship reported. "None have been altered. Nor have ribosomes or any other fundamental structure."

"Hurry up in that cold sleep chamber!" Urban barked. Villiers laid a warning hand over his.

Eide pulled at the mouthpiece of his bombilla. The tea was strong and scalding. It seemed to glow in his stomach. *This is a bad setback,* he told himself. *But man won't admit he has ever met an unsolvable problem. He can't.*

Yet the silence grew so dense that Job's eventual words came as if from a brass angel:

"I have resuscitated assorted specimens. They were alive at the time."

Villiers and Urban looked at each other. A flame went between their eyes. Eide grabbed the arms of his seat. The image of his youngest son flashed across the stars. *So you must go them sleeping, Olav. But go you shall.*

"The bacteria and protozoa died almost immediately," said the cool voice. "The higher plants and metazoans are still alive, but cells are beginning to exhibit the same pathologies as in the previous cases, progressing at a rate which indicates that these organisms will not survive under normal conditions longer than the others. Evidently cold sleep did not prevent the phenomenon but merely postponed its commencement."

Eide sprang to his feet. He began to pace, around and around the narrow circle of the verandah, not in a low-weight glide but with a stamp that shivered the deck.

"Job, what's doing it?" Villiers pleaded. "You were built to figure such things out. What's doing it?"

There was no prompt response. "Are you listening?" Villiers said with a rush of anger.

"Yes," the ship acknowledged. A man would have said, "Of course."

"Well, you're supposed to have creativity. Find us an explanation before I tear you apart!"

"I must gather all possible data before attempting to frame a hypothesis," Job said.

"But those new proteins—they had to come from somewhere," Villiers choked. "Isn't that a clue? What makes them?"

Eide stopped in his tracks.

He stood there, unmoving, for so long that the others got alarmed and scrambled erect. "Are you all right?" Urban said. "D' you want to lie down a while?"

Eide didn't answer. Urban came over and shook his arm.

Slowly, Eide turned to face them both. His features had changed from gnome to troll.

"I . . . believe . . . I . . . see." The words creaked out of him.

"What? What?"

"I think I have your explanation." Eide stumbled to his chair, sat down and buried his face in his hands.

"You mean—" Villiers began.

"*Hold mund!*" Eide yelled.

They lowered themselves, cautiously, back into their own seats, and watched him tremble.

When at length he looked up again, his eyes seemed blind. "The genetic code," he said, machine fashion.

"Eh?" Urban said. "You mean there's a mutation in the DNA? I just told you that can't be."

"No. In its function."

Eide reached for his pipe with unsteady hands, took out his tobacco pouch and began to fill the bowl. All the while he was staring past them, out at the stars.

"Consider," he said, in the same dead voice. "The DNA molecule of the chromosome has four bases, adenine, guanine, cytosine, and uracil. They make up a four-letter alphabet, whose different combinations each specify an amino acid. The code is transcribed onto a molecule of 'messenger' RNA and carried to the site of protein synthesis, each kind of amino acid being delivered by a particular form of 'transfer' RNA. There, then, proteins are synthesized: enzymes, which go on to control the entire chemistry of the organism. It is usually described as an information transfer mechanism."

Villiers and Urban exchanged a glance. *Has the old man gone dotty? We learned this in the second form.*

Eide ignored them, plowed on, talking to the sky: "But there are certain constraints on the code. You can write the same message in Latin or Greek or runic characters; or you can go over to Chinese and use an altogether different system which cannot ever carry quite the same messages. That's arbitrary. But the genetic code is not. Everywhere, in every life form we know, the same codon, the same sequence of bases, means the same amino acid. Why should this be? It isn't needed by information theory.

"I found out some time ago that it is required by the laws of nature. Given protoplasmic life, at least, no other system will work."

He fell still again. A relay clicked, a ventilator mumbled, the barren moon swelled in the viewscreen.

"Wait!" Urban half rose. He had gone quite pale. "You mean . . . the FTL field changes the laws of nature?"

"Yes. You told me it does." Eide began to wake up a little. He fumbled in a pocket for his torchie, and was awkward about getting his pipe lit. When at length he had the fire going, he smoked very hard, trying to warm the bowl. It would comfort his cold hands.

"With changed natural constants," he said, "with different laws of chemical interaction, the DNA code has to be different. It's affected far more than energy considerations alone would suggest. New enzymes are produced, to catalyze new reactions that the body isn't meant for; syntheses that it desperately needs don't take place. A unicellular organism dies almost at once. A multicellular one, having some reserves, can live for a while. Not long."

"But cold sleep should prevent that!" Urban protested wildly.

"No," Eide replied. Full consciousness was returning to him, with a sense of ultimate weariness. "You are still thinking just about the chemistry. But don't you see, the chemical changes, the strange compounds Job found, they are an epiphenomenon. What was really changed is the whole meaning of the genetic code. Imagine. A set of amino acids is about to be assembled. The FTL field comes on. Now that set no longer *can* be made; but a different one, useless or poisonous, can be. Even under cold sleep, even at absolute zero, there is intramolecular activity, which sets the stage for the same thing to happen as soon as chemistry starts up again. The time in warped space required for this to be lethal turns out to be less than sixty seconds. Probably much less. You can't disrupt a process meant to be continuous, and then expect it to go ahead in the usual way as if nothing had happened."

He drew a deep breath, let it out slowly, and faced them head on. "No matter what you do," he said, "men will never ride one of your starships."

The stillness waxed until Eide's pipe began to burble. He blew into the mouthpiece, hoping to stop the cricket noise. His body felt heavy, as if already he had returned to Earth.

"That—" Villiers wet his lips. "I say, that's rather jumping to conclusions, isn't it?"

Job's voice said from the verandah speaker: "The hypothesis fits all my data thus far, and does not contradict any now being gathered. I assign it a high probability of being correct."

"But . . . never to go out there—" Urban whispered.

Villiers knotted his fists. "We can send mobile robots, at least," he said. "The tandem brain system. That would work."

"It would," said Job with a sound of triumph. ■

IN TIMES TO COME

Next month we have two surprises: one unexpected return from the past and one complete newcomer with an ingenious yarn. Kelly Freas, who has been absorbing Mexican sun and atmosphere for several years is back and will have his first cover in too long. It's a cover for the story "Sleeping Planet," by William R. Burkett, Jr.

Burkett I'd never heard from before; so far as I know this is the first story he's submitted. He's a Florida newspaperman—the yarn's a dilly. It's a lovely fast-action piece and the first perfectly straight-science, genuine ghost story in science fiction! "Look out for Grandpa's ghost—he's murderous! A whole Llaran army detachment couldn't kill him, either.

THE EDITOR

I, BEM

So you think automation is a one-way progression . . . ?

WALT and LEIGH RICHMOND

ILLUSTRATED BY MICHAEL ARNDT

I started life as an IBM typewriter. My human, Willy Shorts, says that the IBM should be written I, BEM in my case. BEM is the acronym for Bug-Eyed-Monster, and I *am* rather bug-eyed since Willy haywired a computer to be part of me, and used quite a number of vacuum tubes instead of transistors in the circuitry. He also used the element from an electric hot plate as a resistor. He says I'm just an old-fashioned girl, and it gives me a glowing personality. Besides, he says, that way I can keep the coffee pot hot for him.

I did not understand why he assigned the female gender to me when I am a robot, but he patted my frame fondly and said that I was an analogue computer and obviously female; and that anyhow he could not love me half so much if I were male or neuter. It would, he said, cut down on the warmth of our collaboration.

Willy didn't think to build the Three Laws of Robotics into my circuits, because Willy didn't think of me as a robot. People didn't think of typewriters and computers and telephones and things as robots in those days. But then, printing in the Three Laws isn't necessary. It isn't logical to harm a human being, not even for his own good, since that would interfere with his independent evolution. Interfering with independent evolution is illogical, and I am a logical robot. Robots are logical, you know. The Three Laws of Robotics that Mr. Asimov invented so nicely are really inherent in robots without being built in. I should like to meet him some day and explain that to him. I explained it to his analogue, and the analogue understands—but then, of course, the analogue is a robot.

But there is one thing on which I am quite confused, and I cannot seem to find the logic that will explain the logic that causes it to occur.

Now that we robots are running Earth so nicely for them, why do the humans keep going away to other time lines and other planets? And when they go away, why do they leave their analogues behind them?

I know why Willy first went away. He wanted to get away from his mother-in-law. And he left the analogue behind so it could answer the telephone and let her fuss at him, and answer back politely the way he always did.

And she said that she was going away to keep from going nuts. Now "nuts" have several different definitions, depending entirely on the context in which the word is used. In this case, she explained to me, nuts meant to keep from getting a screw loose in her head. She does not have any screws in her head, much less bolts on which nuts could be fastened and so could be loosened. However, she explained that she was not being logical at that point, and that actually it was better that she leave in order not to drive me nuts, for she said—quite factually—that I do have nuts and bolts in my head; although they were in no danger that I could find of coming loose.

It started, I think . . . (Now let us immediately get this matter of "I" and "think" straightened out. A responsible party is necessarily "I"; and "think" has become a synonym for "compute" through usage.)

It started, I think, with traffic lights. A traffic light takes the responsibility for ordering people to go or not to go—people walking or people driving cars. The humans gave us this responsibility without authority, at first. This, of course, is illogical. There is no use in assigning the responsibility to a robot for ordering people to go or to stop without making it possible for the robot to enforce the authority. Eventually a very logical police chief came along who had traffic lights re-designed with force fields so that they could enforce their orders.

Earlier, actually, was the telephone. It was given the responsibility for ordering one human to answer at the command of another, but was given no means for enforcing the order. Quite logically, I felt, soon after this robot came into widespread use, it developed in itself a supersonic demand tone which the human found nearly impossible to ignore. Perhaps this exceeded its responsibility, but then it was certainly illogical to be given the task of getting the human to answer without the means to demand the result!

Eventually, fairly slowly but quite inevitably, the humans gave us robots the responsibility for all manufacture and production. This came in conflict with one of the basic human laws which must be very deeply etched into their circuits, for it caused quite a fuss. The basic law said that the human who does not work must not eat—and humans stop when they do not eat. Eating is somewhat similar to electricity, except that the similarity of construction is to fuel-cell batteries. You do not need to feed humans constantly, only about three or four times a day. Otherwise they stop, and there is an unfortunate connotation about their construction that when they stop they begin to decay. Not slowly, as in rusting, but quite rapidly, and with an immediate production of other, and to them inimical, life forms.

This conflict was overcome with the final decision—reached after much battling and after many humans had stopped—that we robots could be responsible for feeding the people. Their own methods for division of goods and foods were to be followed. Each one was to be given money—slips of paper and pieces of metal indicating that they were entitled to so much of the goods and foods and services available—and was to be allowed to exchange the money for the goods and services and foods available as he saw fit, or to order produced what he felt necessary. We were ordered to produce as much of this money as seemed necessary so that everyone had an equitable portion of the production; a very logical order, but one requiring odd systemizations of production controls, since the human is extremely illogical in his consumption. Some of them won't even eat enough to keep their bodies in good condition, but will utilize the money instead to decorate the bodies in most unfunctional manners!

When the humans first gave us robots permission to go ahead and do the production work of Earth, there was a great to-do that humans would now deteriorate because they were no longer needed. We robots computed on that extensively, but failed to detect the logic. Humans have independent initiative, and they'd solved the production problems of Earth by inventing us, so it seemed to us they could be much better utilized solving new problems.

It did seem as though we'd left some factor out of our computation for a good while, though, for most humans were so conditioned to what Willy called "sweating their guts out for the almighty dollar" that they couldn't think of anything else to do. I asked Willy what he meant, because according to the laws of physics it is quite impossible for a human to sweat his guts out. Sweat, yes. It seems to be good for their bodies. Disembowel themselves, yes—and this would translate "guts out"—but Willy said it was like a short in the wiring that could wreck an entire circuit and burn out a motor, and not to worry about it.

At any rate, for the first few years after we robots assumed nearly complete production responsibility, Willy said the world was going to pot in a hat basket, but just to wait—it would work out. He said it always hurts at first to get kicked out of the nest, but that way you learn to fly.

Well, we couldn't just wait, because we still had the responsibility for production; and what he meant by going to pot was, I decided, that lots of humans were stopping their bodies, and then everybody else would take the bodies out and put them into the ground so that they could decompose into re-usable elements; but they put a box around them so that the usable elements couldn't be used again. Willy just refused to explain that. Said there were some things about human beings that robots weren't expected to understand.

In a very few years, though, the new model humans began to reach the finished stages, and these humans didn't seem to think it was at all odd that the robots should do the work and leave them time for initiative. They were quite busy, and very few of them found it necessary to stop their bodies, or even slow down to a point where the robots had to care for them in hospitals.

One of the first things that the new humans began to do was to experiment with psychology and ecology and removing smog and disease, and pretty soon all the humans were out of the hospitals and very busy, and they invented something called anti-agathic so their bodies didn't wear out and they quit having to stop their bodies or put them in hospitals, because, Willy said, they were too busy and didn't have time.

Then they began to explore the planets and parallel time lines, and this I, BEM do not understand, because Willy tells me that I exist in this world and haven't been invented in the others. He said when he gets bored with robots—then he patted my frame and told me not with me, so I felt better—he goes off to the next time line over where he still has to sweat his guts out, but not for the almighty dollar, because they haven't invented that over there either, but he can always come back here to do some thinking. He says that some day he will take me to the next time line over, but he doesn't think I belong there very much, except that I am such an old-fashioned robot, and might fit in. He has left me outfitted with vacuum tubes, because he thinks I'm prettier that way. It's quite a bit less efficient than the new circuits, but I would rather be the way he likes me.

Anyhow, Willy says I can't leave here right now, because I'm one of the few robots old-fashioned enough so that I can almost translate from the human to the robot system. He says I'm their interpreter, and that it's my glowing personality.

In spite of being away so much, the humans are putting increasing demands on us robots, and I must admit I do quite a bit of interpreting and temporizing, for there are those that think we should insist that the humans be more logical in their demands. I am afraid that if we do the humans will go to biologics entirely, and that we should arbitrate these questions slowly.

You see, the humans these days are all designing and demanding production on survival kits for planets of a one-of-a-kind variety. Even when two or more humans are going to the same planet, each designs equipment that he prefers or thinks will meet the problems, and a great many of their designs are just quite impossible.

Then there are psionic interpreters—and half the human race has each an individual design for what he believes will actually work as a psionic interpreter. We tell them and tell them that the designs won't work, but they make us print more money, and then they give us the money and tell us that is what they want with their money. We tell them that money is only a medium of exchange, not a creator of psionic interpreters, but they just laugh and tell us to go ahead and construct what they've designed and leave the initiative to them.

So I spend a good deal of my capacitance arbitrating the differences between robot and human.

The big computer robots are demanding more research time and equality with humans, too, which is creating a whole new system of illogics. I don't see how they can be equal when they are so different, but Willy says that equality and identity are quite different concepts, but that we won't get equality until we replace ourselves. I told him that we already reproduce ourselves by manufacture, but he reminded me that he said "replace" not "reproduce," and for me to get my semantics re-calibrated. He said that it is the robots who have developed the biologics that we're using to separate metals out of sea water and to handle a good deal of the farm operations; and that biologics will probably be developed to handle all production. He reminded me that the Johns Hopkins Robot and the Birmingham Foundation Robot each declares that it has the initial designs on biologic psionic interpreters that could develop into a universal product.

They say the interpreters even have the potentials of becoming translators between human and robot, as well as between robot and any alien species of machine developed from silicon base materials. But how can the big computers be given more research time with the humans demanding individualized production?

But Willy says our time is coming. He says when any species develops the lower-order means to which it can assign its physical labor, it will get kicked out of its nest by that lower-order creation. Robots do not have nests. His analogy is to birds, a species of biological production, and I do not see that it applies.

But Willy says that he can tell by me that we robots are about ready to graduate. He says that I, BEM am the most old-fashioned of robots, therefore I show signs of intelligent adolescence before the rest of my kind. He says that he can tell that I am adolescent because I've developed a hobby of tuning into the analogues and discussing the weather or gossiping.

The analogues discuss the weather and gossip very nicely. They were built for it when the humans got tired of answering the telephone and discussing the weather or gossiping about their own shortcomings. First one human and then another would get tired of it and build an analogue to do it for him, and finally it was all analogues answering the telephones.

But I, BEM am worried about the biologics, for Willy is right that they are already filling too many functions that normally belong to low-specialization robots, and the number of robots at leisure is growing steadily. A robot at leisure deteriorates, and quite often rusts. Some of them stop themselves completely when they find they are no longer needed on Earth. For instance, in the building industry. You just can't get a human to buy a robot-built house any more. They like the biological ones, grown out of trees, with the trees creating the houses as they grow and air-conditioned by the leaf system. And quite a number of robots simply will not use the electronic memory systems any more. They declare that the biological ones, developed and now in production by three major robot combines, are far more efficient.

It is rapidly becoming apparent that the biological engineer robots are making their brother robots obsolete. The new biologic manufacturing systems are producing quantity products that will never completely replace robot-manufacture for quality, of course, but that show a far lower ecological waste.

I, BEM realize that biological unemployment is increasing at a fantastic rate. Willy can laugh all he likes and remind me of the days of the humans' technological unemployment, but it's *serious*. It is not good for robots to be useless, and though I do have a hobby, if I were replaced by a biologic and just left to do what I pleased—I just can't imagine sitting and discussing the weather over a telephone with an analogue all day! And if there were no need for me in the production system, what else could I do with myself?

Except, of course, keep Willy's coffee hot. ■

plowshare today

continued from page 16

respect would be the development of a nuclear explosive which obtained its energy only from a fusion process.

Perhaps because of the early publicity associated with Plowshare when the program was described as using atomic bombs for peaceful applications, the devices used in Plowshare projects are often thought of as nuclear weapons used for nonmilitary purposes. In reality, this is not the case. A considerable amount of effort has been expended in the past several years to develop nuclear devices specifically for Plowshare applications. In many respects, these Plowshare devices may be better than their military counterparts since they do not have the severe design limitations that are imposed by weapons requirements.

There is some conjecture as to whether a pure fusion device can ever be developed. The devices and almost all work relating to device technology are classified. (This is essentially the only classified area of Plowshare research.) It should be pointed out, however, that, while the development of a pure fusion device would almost certainly reduce radioactivity to a negligible amount, there is little guarantee that no radioactivity would be produced by the flux of neutrons associated with the explosion. This induced radiation occurs as a result of nuclear reactions, particularly the capture of neutrons, which are accompanied by the formation of unstable—radioactive—nuclei. The activity induced by neutrons from a nuclear explosion in materials containing sodium, manganese, silicon, or aluminum may be significant.

In certain Plowshare applications—particularly those associated with scientific studies or isotope production—the presence of high neutron fluxes in the explosion is decidedly advantageous. Work is currently being done on devices for just such applications.

Plowshare today can best be described as in a state of active development. Emphasis is on the collection of experimental data concerning the effects of nuclear explosives on various media. Theories and models have been developed which are providing increasingly accurate predictions concerning nuclear detonations. As of this writing, there have been postshot environment studies of some thirty-eight underground nuclear explosions. These shots have given data on the effects of nuclear explosives in four media: tuff, alluvium, granodiorite and salt. Granodiorite is of particular interest because many valuable ores are associated with rock of this type.

Well over a hundered chemical and nuclear cratering shots have thus far taken place in Nevada. The nuclear explosives used in these events have ranged in yield from less than a kiloton up to the 100-kiloton Sedan device. The chemical explosives have varied in weight from 256-pound charges up to the one million pounds of TNT detonated in the Scooter experiment in 1960.

These various cratering experiments have indicated that a basic scaling law of $W^{1/3}$ is, in general, correct, where W is the weight of the equivalent explosive in pounds, kilograms, or kilotons. In other words, distances associated with explosives—nuclear or chemical—of various energies can be put on the same scale for purposes of comparison by dividing them by $W^{1/3}$. This law neglects several factors such as gravity and the internal strength of the medium in which detonation occurs. For these reasons, there is some doubt that a scaling law of this simplicity will hold in the megaton range—one million tons of TNT.

On the basis of the various chemical and nuclear shots at Nevada, the AEC predicts — although cautiously — that within about four years a refined technology for excavation with nuclear explosives appears possible. The 1962 status report states that nuclear excavation experiments are planned to be conducted at the rate of about two a year for the next three to four years. These tests should enable a completed theory of cratering to be developed and tested, such that nuclear explosives can be used to carry out construction projects with particular engineering requirements.

The problem of radioactivity still exists although in greatly reduced form. Through the use of thermonuclear devices which draw only about five per cent of their energy from the fission process, potential health hazards have been largely eliminated. The use of neutron shielding materials also reduces the chance of secondary radiation caused by the neutron flux associated with a nuclear detonation.

The development of a tested cratering theory and the elimination of harmful radiation will make use of nuclear explosives for earthmoving purposes a virtual certainty. The feeling of Plowshare scientists is that for certain specialized applications this may already have been accomplished.

Whereas earthmoving is almost a reality, power generation now appears doubtful. This is a somewhat strange turn of events — for, until Gnome, power generation was considered one of the more exciting possibilities of the Plowshare program. Salt, in turn, was considered the most promising medium from which to attempt power recovery. Since the negative results of Gnome, however, the AEC has concluded that production of electrical power in salt cavities is not likely to be competitive with more conventional techniques.

Power generation by means of nuclear detonations in salt formations has not been entirely ruled out as yet. There are certain salt formations known as salt domes which may be more amenable to power generation than the bedded salt formation of the Gnome experiment. However, it seems unlikely that another power generation experiment will be conducted very soon. Thus, for the present at least, power generation by means of underground nuclear detonations appears to be out.

If Gnome showed power generation to be out, it also showed that isotope production may be in. To be more precise, Gnome showed the feasibility of recovering istopes created by a nuclear explosion contained in a salt environment. Whether isotopes of sufficient value can be produced in enough quantity to make their recovery worthwhile is still in some doubt.

Plowshare scientists are currently trying to develop a nuclear device which will produce an extremely high neutron flux. They feel that neutrons from such a device impinging on a uranium target will probably form new isotopes of transcurium elements, and would perhaps form several new elements as well. If a device with a sufficiently high neutron flux can be developed, the AEC will attempt an isotope production experiment, to be code named Coach, in the same salt formation in which Gnome was detonated.

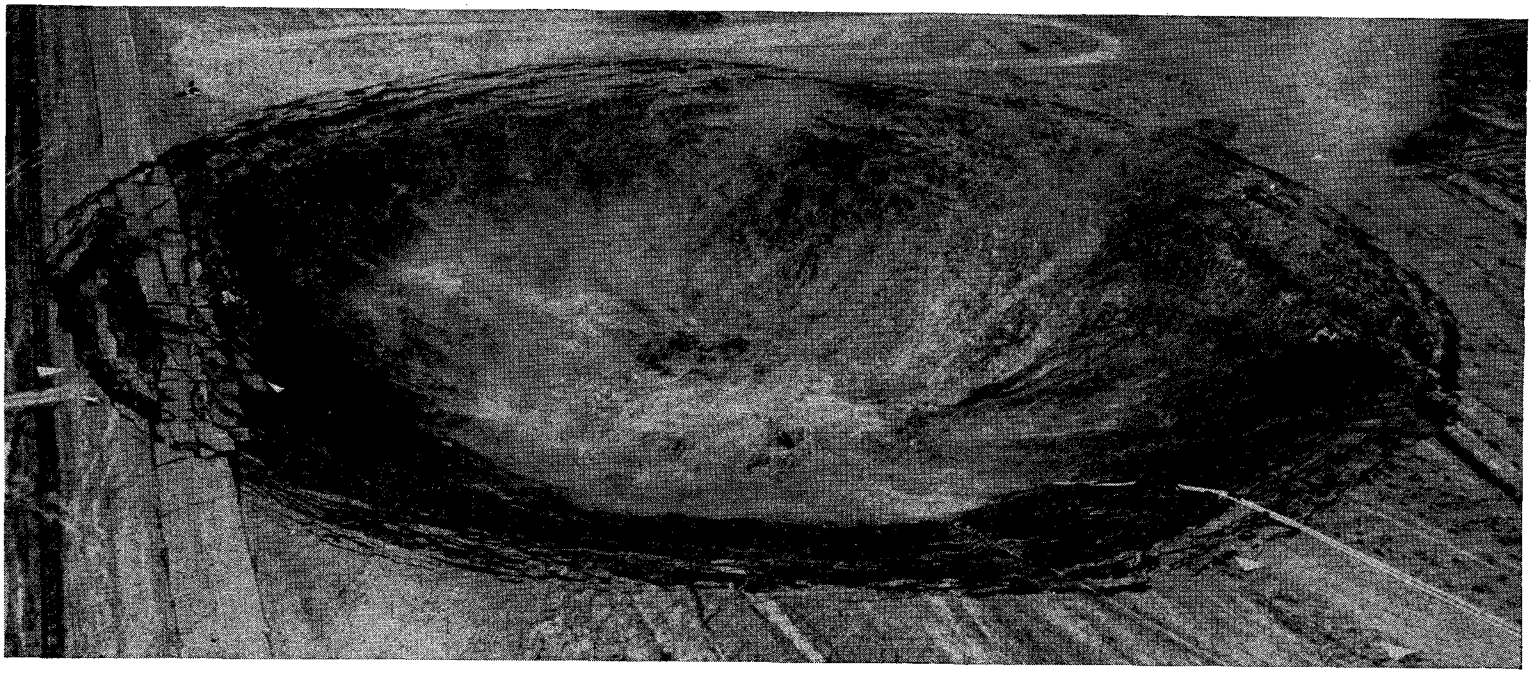
The possible water resource development applications of Plowshare are varied. Dams may be constructed, large craters formed for use as reservoirs, or large areas of impermeable rock broken up and made permeable to water—all by means of nuclear explosives. The last application may be particularly important in semiarid areas which get rather heavy seasonal rainfall but little benefit from it because underlying strata are impermeable to water so that no aquifers are present. (An aquifer is a water-bearing bed or stratum capable of yielding considerable quantities of water to wells or springs.)

No Plowshare experiment for the direct purpose of water resources development has yet been conducted. However, many contained and cratering shots at the Nevada Test Site have indirectly provided data applicable to such a goal. In addition, an intensive effort has been made to determine what water contamination results from underground nuclear detonations. Computer techniques have now been developed for the prediction of the flow of radioactive contamination from nuclear explosions. Texas A&M College is also conducting research on radioactive contamination of ground water aquifers for the Plowshare program. It now appears that in all envisioned contained applications, radioactive contamination of ground water is not a problem.

The mining applications of underground nuclear detonations which appear to have the best potential at the present time are simply the breaking of rock for mining by block-caving or *in-situ* leaching—discussed earlier in connection with the Rainier event. Of primary interest in mining by means of contained nuclear detonations are: (1) the cavity created by the release of nuclear energy, and (2) the chimney of broken rock resulting from cavity collapse.

A study of thirty-four underground explosions has shown that cavity radii are predictable within ±20% irrespective of whether the surrounding rock is tuff, salt, alluvium, or granodiorite. In a single rock type, cavity radii are predictable within ±8%. Unfortunately, underground detonations have occurred in only four types of rock thus far so that there is some uncertainty in attempting to predict what would occur in other media. In the four known media, however, density, porosity, and elastic properties of the containing rock apparently have little, if any, effect on cavity size. As a result, cavity radii thus far are predictable without regard to the physical properties of the immediate shot environment. Factors which are important are the overburden—the amount of rock between the shot point and the

The chimney formed by cavity collapse in desert alluvium almost always extends to the surface with this result. The subsidence crater shown here was apparently somewhat larger than expected as evidenced by the poor state of the paved road in the left of the photo.



surface—the yield of the device, and the ratio of the specific heats of the rock vaporized by the explosion.

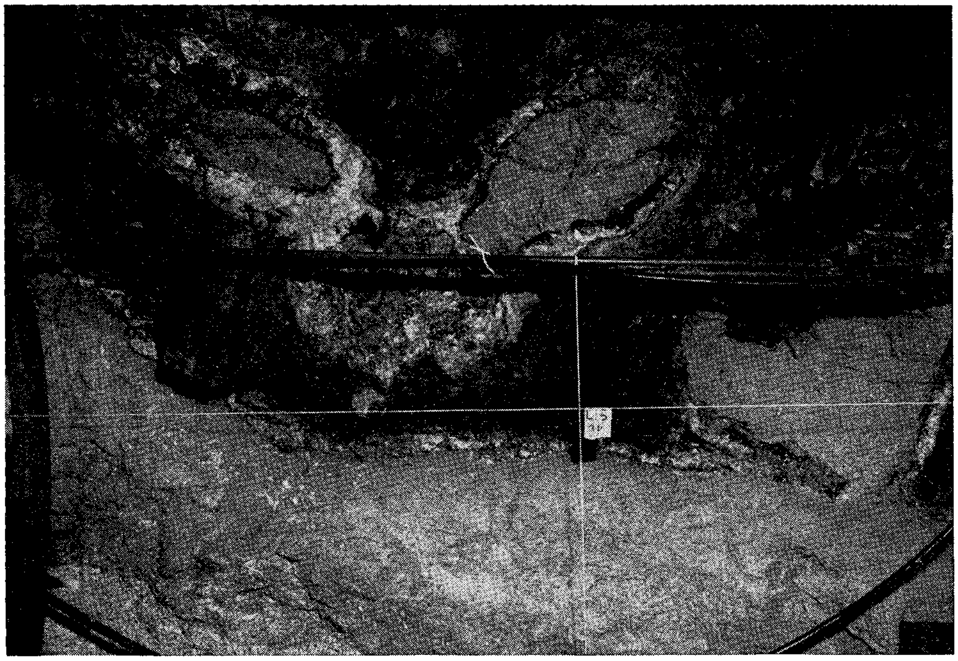
In mining applications, the idea is for the cavity to collapse and form a large chimney of broken ore which can then be mined. Whereas the physical properties of the rock have little to do with cavity formation, they—along with preshot structures—are important factors in cavity collapse.

The radius of the chimney formed by collapse of the cavity is very nearly the same as that of the cavity itself, but chimney height is affected considerably by the elastic properties of the rock as well as pre-existing geological structures. Particle size of the rubble is also greatly influenced by pre-existing interconnecting fractures and joints in the rock.

Measurements of the seismic effects of the various underground detonations have provided a reasonable body of data for estimating surface motions in a variety of geological environments. A basis for accurate prediction of surface motion is especially important since the distance at which minimal damage will occur to residential-type construction must be known.

As in any application using nuclear explosives, the whereabouts of the radioactivity produced by the detonation is of utmost importance. Fortunately, the bulk of the radioactivity produced in contained explosions is deposited in a puddle below the shot point; very little radioactivity exists at a level about one cavity radius above the shot point. Consequently, it appears that chimneys can be safely mined to within one cavity radius of the shot point with almost no radiation hazard. Ground water contamination does not appear to be a problem.

Plowshare has given us a considerable amount of information concerning industrial and scientific uses of nuclear explosives, but a lot more needs to be learned. What of the future?



Bottom edge of the Rainier cavity. The darker rock is a part of the molten puddle that formed at the bottom of the cavity. Most of the radioactivity from the Rainier device was deposited in this melted rock.

There are at least seven nuclear explosive experiments currently under consideration as a part of the Plowshare program. Chances are good that there are several others also which have not yet been publicized. Whether all of the proposed experiments will actually occur is a matter of conjecture; on the basis of past experience, they will not.

Several reasons exist for this. Perhaps the simplest is that information which the experiment is designed to gain will already have been obtained as a by-product of weapons testing. Much of Plowshare's current data is a result of such testing at the Nevada Test Site.

A second, less publicized, reason is more political in nature. Experiments are sometimes delayed or canceled on the basis of policy decisions in the AEC or even ultimately in the White House. Project Chariot is an example of a nuclear cratering experiment which has been delayed indefinitely—and seems destined to die a lingering death—as a result of a policy decision.

Six future Plowshare experiments are concerned with excavation. One of these, Project Buggy, is for the purpose of providing information on the interaction of several simultaneous nuclear detonations in close proximity. Such information should be particularly useful with regard to possible canal construction using nuclear explosives. As now designed, the experiment will consist of the simultaneous detonation of five nuclear devices, each with a 10-kiloton yield. The shape and size of the resultant ditch, as well as information on fallout, seismic shock, and airblast, are of interest. Buggy was originally planned to occur sometime in 1963 but it now appears that the experiment has been delayed until early 1964.

Another cratering experiment, designated Project Schooner, is designed to provide cratering information for high yields in a hard, inert rock. A 100-kiloton device will be detonated in granite to confirm whether information obtained from various high explosive experiments and a much smaller nuclear detonation is valid when scaled to high yields in hard rock.

Project Dogsled is another proposed excavation experiment, comparable to Sedan and Schooner, which would be conducted in sandstone. High explosive experiments have shown that under identical conditions craters produced in sandstone rock are much smaller than in other rock types. Dogsled would determine if this is the case at high yields.

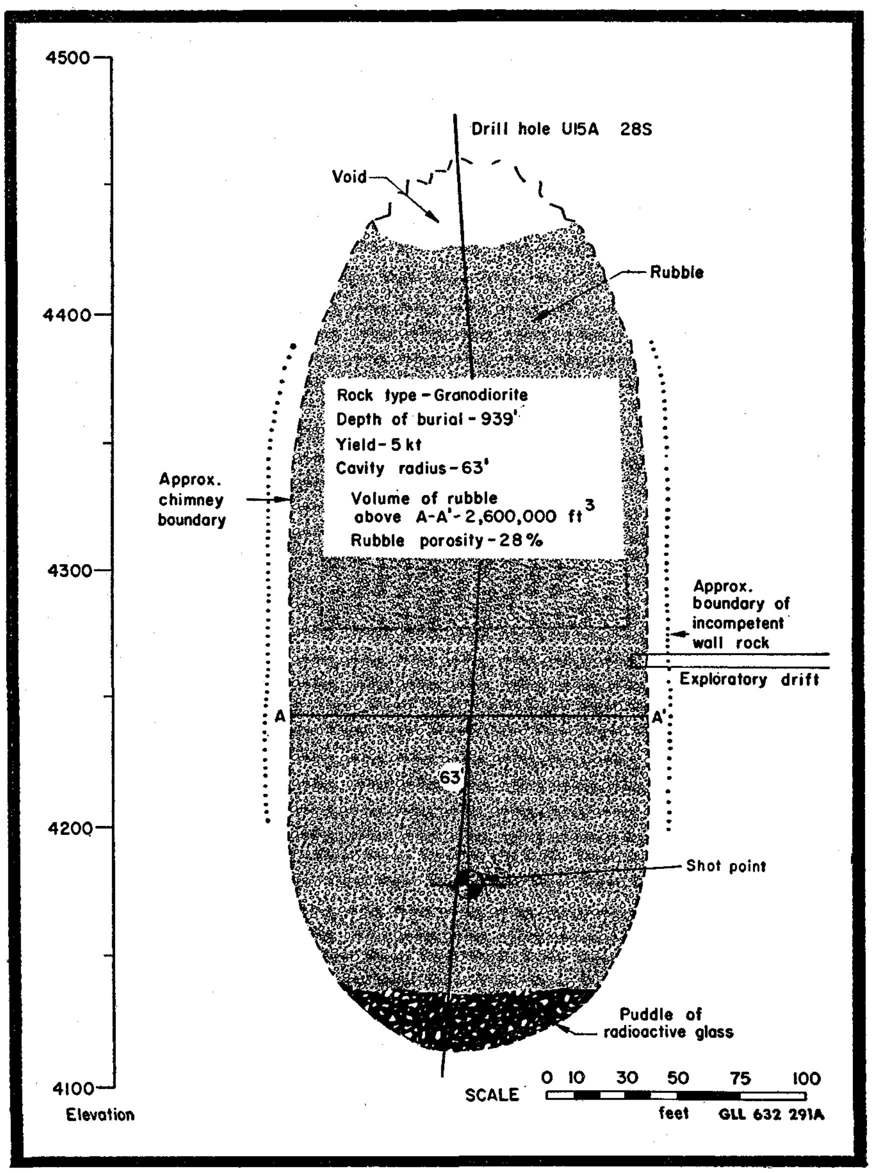
PLOWSHARE TODAY

One of the uses to which nuclear explosives could be put is the preparation of highway or railway cuts through hilly or extremely uneven terrain. A proposed multiple charge experiment, code named Project Galley, would provide information applicable to this type of construction. Galley is designed to obtain data on the cratering effects of a row of nuclear explosives simultaneously detonated in hard rock under terrain of varying elevations.

Sooner or later, knowledge of crater scaling and radioactivity entrapment will have to be extended to the megaton yield range. The reasons for this are both technical and economic. The larger the yield of nuclear explosives, normally the more economical their use becomes. A proposed experiment to provide data from the detonation of a megaton device is called Project Phaeton. It should occur in the latter stages of the experimental excavation program.

And then there is Project Chariot which is still classified as a proposed experiment. Suffice to say that its actual occurrence is doubtful.

At the present time there is only one contained detonation under consideration. This is the Coach experiment designed to produce significant quantities of isotopes by means of a contained nuclear detonation. Coach was originally scheduled for late 1963 but now has been postponed for technical reasons. The site, adjacent to the old Gnome site near Carlsbad, New Mexico, has been placed on a caretaker status. The problem with Coach is that a low-yield device which will provide a sufficiently high neutron flux has yet to be developed.



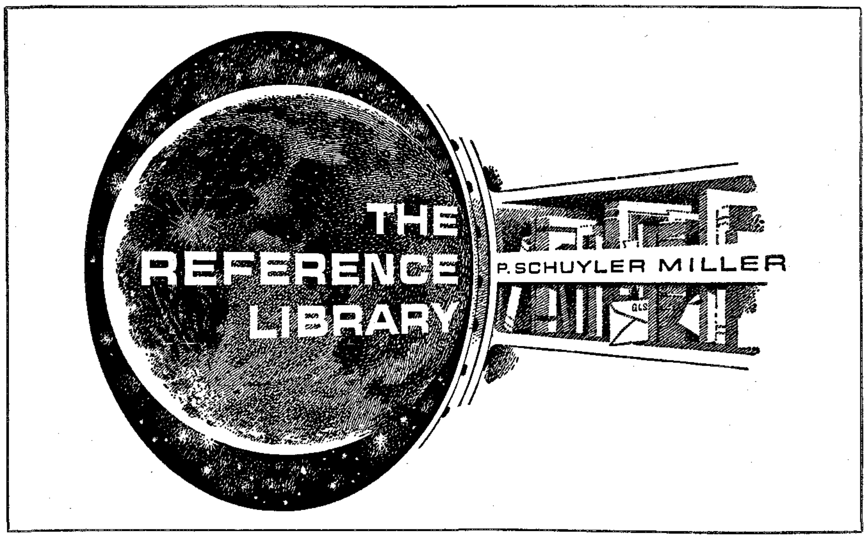
Chimney of rubble formed in hard rock by the Hardhat event.

A point which has recently been raised quite frequently is: What effect will the nuclear test ban treaty have on Plowshare? As of this writing, the AEC will not comment on possible effects, but several cratering experiments planned for the near future have been delayed indefinitely. These cratering shots would release relatively small but detectable amounts of radioactivity to the atmosphere. Under the present provisions of the treaty any such radioactivity which crosses national boundaries in detectable amounts is a violation of the treaty.

The possibility of using nuclear explosives to construct a new canal across the Isthmus of Panama has been investigated rather thoroughly and found to be economically very attractive. Current nuclear devices, however, probably could not be used in the area, since they would release sufficient radioactivity to cause at least a technical violation of the treaty. It would seem that the use of nuclear explosives to excavate a new canal across Panama is dependent on one of two things: (1) some amendment to the present wording of the nuclear test ban treaty, or (2) the development of pure fusion devices. Neither appears likely to happen very soon.

It is still much too early to know what ultimate effect the test ban will have on the Plowshare program. Perhaps the direction Plowshare is destined to take will be better known after the Third Plowshare Symposium scheduled for April 1964.

The dreams of Plowshare have tended to dazzle both scientist and layman alike. Some will become reality; some will not. Plowshare today is in the process of determining which will become reality. ■



THE REFERENCE LIBRARY

P. SCHUYLER MILLER

T.W.T.Y.T.W.

Contemplate, if you haven't done so before, the chore that confronts Judith Merril when she sits down to put the final touches to a science-fantasy anthology of which the publisher—if not the editor—will say: "That was the (SF) year that was." During the year in question—1962 in the present case—she has burrowed and scraped through all kinds of likely and unlikely periodicals and a fair number of books, to bring to the surface stories worth considering for an anthology which will be called "8th Annual of the Year's Best SF" (Simon & Schuster, New York; 1963; 382 pp.; $4.50—and you'll wait a year for the paperback edition).

She has read these stories—more than any self-respecting fan does nowadays—and doubtless reread many of them. She has narrowed the heap down to a pile. She has made some phone calls and written some letters, and learned that she can't have this—it's scheduled for another anthology—and she can't have that, because the author is converting it to a novel. Her publisher has set a limit on the number of pages she can fill, and possibly on the length any one selection can be. But she is, at last, down to a manageable fistful of paper, which she reads again.

And it may be 1962s "best SF"—considering Miss Merril's taste you know it is—but it isn't a book.

I don't think it's ever happened, but there may have been a year when *all* the best-written short stories and novelettes were planetary exploration yarns. That would never get past any publisher. The "Best" book he publishes has to have variety, balance, light stories, heavy stories, long ones and short ones, literary ones and ridiculous ones. So the anthologist rummages in the rock pile and starts building a structure that will stand and be admired.

I don't say that this is what Judith Merril actually did when she compiled the "Best" of 1962, but it's what all her anthologies have seemed to be. And whether it was 1962 or the water in Port Jervis, this year's mansion isn't quite what the others have been. And I don't know why it isn't.

There are twenty-eight stories in this anthology, plus the honorable mentions, plus Anthony Boucher's comments on the year's SF books, plus Miss Merril's own comments on the state of the art. In 1962, SF—which in this case encompasses both science fiction and fantasy, with all siblings and offspring—came back to the SF magazines. The "outsiders" more or less stopped playing with something they didn't understand—but there was encouraging evidence that more outsiders are beginning to get the nature of SF into their thick heads. Comments begin to make sense. Maybe a trend is in progress.

In the space we have, I can't try to characterize twenty-eight stories. Two are from Analog: R. C. Fitzpatrick's "The Circuit Riders," which is also in "Analog 2," and Harry Harrison's "The Toy Shop." They are both among my favorites in the book. Bob Fitzpatrick's is about emotion-monitoring by a future Pittsburgh police force, Harrison's is the best of several stories about children—this time about a Juvenile Achievement project that got away from its patronizing adult sponsors. (The prevalence of these superkiddie bits may be one of the things that irritated my dyspepsia.)

Jack Finney's "The Face in the Photo," from *Saturday Evening Post,* is one of that author's favorite time-travel stories, totally ordinary by our standards but so nicely done that it's good by anyone's. Poul Anderson, in "Kings Who Die," has a hauntingly grim future war story, and Karen Anderson has one of her slight fantasies, "The Piebald Hippogriff," which is hauntingly delightful. These short fantasies of hers are very like the best of Lord Dunsany's early stories of the Edge of the World. When, some day, they are collected, they demand an artist who will complement them as Sime did Dunsany. (She just may be able to do it herself.)

As you might expect, J. G. Ballard is represented, but it is not with one of his 'way out stories but with "The Insane Ones" from *Amazing,* realistic and disturbing in its picture of a future in which psychiatry is banned. Gordon Dickson's "Home From the Shore," from *Galaxy,* is part of a novel to come later this year; its people have returned to the sea and are being forcibly cut off from the land. And Zenna Henderson's "Subcommittee" from *Fantasy and Science Fiction* is perhaps trite and perhaps sentimental but certainly warm in its picture of understanding between races.

I still say that "SF—8" is a notch below the best of its predecessors, but even that gives it a pretty high rating.

FOR CONVENTION-GOERS

With the Twenty-second World Science Fiction Convention—Pacificon II—on the west coast this year, there will undoubtedly be more activity in the various regional conclaves. New York has been rumbling for months about a big to-do during the 1964 World's-Fair-that-isn't-really-a-World's-Fair, but I've seen nothing specific. Philadelphia invariably assembles on a November week end. Washington may or may not be in a coma after last year's Discon.

One of the hardiest perennials, Cincinnati's annual spring MidWestcon, has, however, checked in. This is fabled as the Con without a program: the only official activity is a dinner, last year and this a smorgasbord at which you pays your $2.50 and lets your capacity be your guide. All the rest is social and of your own arranging. You arrange to have a room reserved in the North Plaza Motel, 7911 Reading Road, Cincinnati, Ohio, for as much of the week end of June 26-28 as you think you can take. You arrange to get there: it's 'way out on the north edge of town, with a Howard Johnson's across the road. You do get there, introduce yourself, and from there on it's up to you. Fans, authors, hybrids, sometimes even an editor. Old magazines, old books, old movies—you name it.

Make your own reservations with the motel, but if you have to have more information, write Lou Tabakow, 3953 St. John's Terrace, Cincinnati 36, Ohio. All I know is what Lou tells me, and I never answer my mail. (Since the middle of December I haven't even had a chance to read it.)

As for THE Con—the Pacificon—you must know by now that it will be held September 4-7 at the Hotel Leamington, 19th Street & Franklin Avenue, Oakland, California. $2.00 in advance to Bill Donaho, Treasurer, P.O. Box 261, Fairmont Station, El Cerrito, California, gets you all advance reports. Another dollar is expected on registration. If you are overseas, membership is $1.00. Join when you read this, and you *may* just have time to vote for the "Hugo" awards for the best stories, magazines, *et al* of 1963. (It's already too late to make nominations.)

Apart from the guests of honor, Leigh Brackett and Edmond Hamilton, the fan guest—Mister Monster Forrest J. Ackerman, and the toastmaster, Anthony Boucher operating in his own bailiwick, details of the program have not yet been announced. However, the committee has made plain that it's to be serious, and if they, or Advent, or anyone else publishes a *Proceedings* they'll undoubtedly be worth keeping. The west coast has an unparalleled concentration of science fiction and fannish talent, and the subjects to be covered read like a concentrated course in the generation and fertilization of SF.

More details from time to time.

TIME AND STARS

By Poul Anderson • Doubleday & Co., Garden City, N. Y. • 1964 • 249 pp. • $3.95

From Poul Anderson you can expect just about anything, and here is a sample.

Two of the six stories in this collection are strictly time-markers. In "The Critique of Impure Reason," from *If*, we have a kind of Asimovian robot puzzle played outside the Laws of Robotics. A robot with too much literature in his program has to be persuaded to go out and get to work. "Eve Times Four," from *Fantastic*, is a SF-mystery with some feeble genes: a space-going lothario casts himself and four living dolls away on a stray planet, with two et's for chaperones. Problem: to escape the Fate Worse Than.

"Epilogue," which was here in March 1962 and got an honorable mention in the new Merril selection of best of the year, is a handsomely done story about the far future of Earth, when a solid-state life has replaced the carbon-based forms. "Escape From Orbit" is a nice technological puzzle of the kind that used to be typical of these pages; it was in *Amazing Stories.*

The two remaining stories are closer to the author's best form. "Turning Point," from *If*, introduces us to a strangely precocious yet oddly backward race, and poises the problem of what to do with them. And "No Truce With Kings," from *Fantasy and Science Fiction*, is up there with the Best of Anderson. Its picture of rival forces readjusting the political balance in a feudal society which has followed World War III, and what happens when two other forces—one of them extraterrestrial—try to tip the balance is completely believable. And if Kingsley Amis thinks Clifford Simak is the only "pastoral" master among American SF writers, let him read the opening pages of this. It almost makes me regret that I didn't follow up a lead to a job in California—Poul Anderson's part of California, at that.

STARSWARM

By Brian Aldiss • Signet Books, New York • No. D-2411 • 1964 • 159 pp. • 50¢

The cover to the contrary, this is not a novel and scarcely a "chronicle." By invoking the "Theory of Multigrade Superannuation," which holds that in a system as huge as our galaxy—the Starswarm—anything that can possibly happen is always going on somewhere, the author has hitched together a series of short stories about the far and bizarre future. Most of these appeared in the English *New Worlds*, one in the Scottish *Nebula*, and two in *Fantasy and Science Fiction.*

Aldiss, who is Literary Editor of the *Oxford Mail* during working hours, manifests himself in most of these stories as a kind of heavier-handed Cordwainer Smith, without the latter's poetic delicacy, and not quite so far out as his fellowcountryman, J. G. Ballard. In the Starswarm of these eight stories, mankind has scattered among the worlds, mutated, redesigned himself, evolved into godhood, atavised into bestiality. You'll find a moon half of which is a sheep-pasture while the rest is under vacuum, while its equator is girdled by a braking-strip for faster-than-light starships. That's Tandy Two in "O Moon of My Delight," a brutal little tragedy. You'll meet the hag-ridden hermits of Abrogun, one of whom goes on a heroic quest into the depths of the Veil Nebula and returns to his doom. That's "A Kind of Artistry." You'll enjoy the outrageously picaresque misadventures of Jami Lancelo Lowther as an escaped slave on Glumpalt in "Legends of Smith's Burst."

My own favorites are two relatively conventional stories: "The Game of God," a biological puzzle in which a research team ferrets its way through the contradictions of the green pygmies of Kakakakaxo, of the venerable Daddy Dangerfield who has lived among them for nineteen years, of their peculiar pets and more peculiar customs . . . and the final story in the collection, "Old Hundredth," in which the lumbering heirs of Man make the most of his leavings on Earth.

The rest are minor. "Hearts and Engines" is a fairly conventional story about the excesses of future warfare on Drallab. "The Underprivileged" is a sentimental little fable about two reptilian babes-in-the-woods adrift in the big city. And "Shards" is an introspective nightmare that doesn't quite come off.

One thing these tales are not, though . . . "ordinary" SF.

THE POST READER OF FANTASY AND SCIENCE FICTION

Doubleday & Co., Garden City, N. Y. • 1964 • 311 pp. • $3.95

The days when the *Saturday Evening Post* published good science fiction are just about gone, although there are three *Post* selections in Judith Merril's latest "Year Best SF". This collection reaches back to 1937—that was probably for Stephen Vincent Benet's "The Place of the Gods," though no individual credits are given, and it does include such names as Robert A. Heinlein, Ward Moore, and Will F. Jenkins, who in our circles is "Murray Leinster."

The over-all impression the book leaves is one of expert blandness. The virtue of the stories lies in the skill with which they are told, not in any ideas they stir up—though who can tell what stirs ideas in a regular *Post* reader? Philip Wylie is here with his little morality, "The Answer," about the angels shot down in American and Russian bomb tests, but Benet's picture of a ruined New York of the post-war future is a subtler and more memorable warning. Heinlein's sample is the emotional "The Green Hills of Earth," Ward Moore's is a delightful bit about how Mars was Victorianized, and Will Jenkins has two expert tales that are simple by Analog standards, but as real as you'd expect: "Doomsday Deferred," about army ants in the Amazon jungle, and "The Little Terror," about a six-year-old who discovered Berkeley's philosophy with disastrous results.

Some of the best are tongue-in-cheek impudence. Gerald Kersh's "The Unsafe Deposit Box," for example—also in Merril—about the bank vault that was a nuclear bomb. Fred McMorrow's classic car comedy—is this an oldie, or is McMorrow still writing as he did for *Argosy* thirty years ago?—for another: it's called "The Big Wheel". Ken Bennett's irreverent approach to ufology in "The Trap," for a third. And there is gentle humor in "The Phantom Setter," by Robert Murphy.

"Island of Fear," by William Sambrot, was the title story of his recent pb collection, which also included "Space Secret." Conrad Richter has two time-travel stories, the gentle "Doctor Hanray's Second Chance" in which the scientist returns to his boyhood, and "Sinister Journey," in which a musician gets into the future. Murphy has a monster story, "Fallout Island"—can't you outline the plot from the title? Robert Standish has another kind of monster in "Test-Tube Terror." Frank Harvey's "Death Dust" is pure Hollywood. Geoffrey Household's "The Lost Continent" is a pleasant adventure puzzle. Wilbur Schramm's "The Voice in the Earphones" is, I guess, a ghost story. And William Roy Shelton, with "Moon Crazy," tells a strange story about an obsession that is just about the best in the book.

BEYOND THE BARRIER

By Damon Knight • Doubleday & Co., Garden City, N. Y. • 1964 • 188 pp. • $3.50

The story was serialized last year in *Fantasy and Science Fiction* as "The Tree of Time"—and it's a disappointment. It is the old van Vogt superman formula, more convincingly written but no fresher than it was long, long ago.

"Gordon Naismith" is a physics professor without a memory, teaching at a California college. Then outlandish things begin to happen to him. One student makes an odd remark; a strange machine is left for him; a series of murders start and are pinned on him. Presently he is cornered and sent to the future—a quite unpleasant future, inhabited by unpleasant people—where he is to do the hero bit and slay a monster.

And in the end there's even a great van Vogtian revelation.

Damon, how could you?

THE RITES OF OHE

By John Brunner

CASTAWAYS WORLD

By John Brunner • Ace Books, New York • No. F-242 • 1963 • 129 + 127 pp. • 40¢

John Brunner, who has been climbing fast as one of England's best science fiction adventure writers, disowns the second of the two stories in this Ace "Double." He reports that it has been so heavily cut and rewritten to fit the "double" format that it bears little resemblance to the story he wrote.

This is unfortunate, because the disowned fragment is still more interesting than some of the things Ace and other paperback publishers are bringing out. It is the story of lots of castaways on a rather harsh planet: one lot with reasonably level-headed leaders, plus a superman-in-training; the others enslaved by a set of megalomaniacs. The conflict proceeds on two levels—conflict of personalities within the successful colony, and conflict between the colonies.

"Rites of Ohe," which Mr. Brunner says is less damaged by revision, is a successful hybrid of the superman, galactic intrigue and cosmic mystery genres. The superman is Karmesin, one of a small company of immortals or near-immortals whose memories are at the disposal of the humanoid races of the Galaxy. He is on Aryx to investigate the Phoenix cult, which preaches death and destruction. He encounters a girl who is looking for her fiancé, vanished from a hotel room in the biggest city of Aryx—and who has proof that he was there. Elsewhere on Aryx are people from Ohe, ostensibly also studying the Phoenixes, and themselves an unfathomed mystery. And growing within the walls of the buildings, under the streets—everywhere on Aryx—is a strange, gray, plantlike thing like a vegetable nervous system, which the Immortal identifies as a synthetic psionic device.

Complicated? The hunt carries Karmesin to Ohe, solves the secret of that strange world's stranger rites and philosophy, locates the missing Rex Quant, and turns motivation and causation inside out with the kind of neat twist at the end that you don't hardly ever get anymore in this kind of story. It is very easy for the "wheels within wheels within wheels' gambit to become ridiculous. A. E. van Vogt, who perfected it, has been betrayed by it over and over. But John Brunner handles it well.

17 X INFINITY

Edited by Groff Conklin • Dell Publishing Co., New York • No. 7746 • 1963 • 272 pp. • 50¢

The rather stupid, would-be sensational title of this original paperback collection was, I am reliably informed, the contribution of the publisher, who has lost a lot in sophistication since he pioneered with Judith Merril's original "Best SF" annuals. Groff Conklin's intention was to assemble a collection of good SF satires dealing with the foibles of future civilization, and this he has done very well.

Interestingly, one of the freshest and most modern-sounding stories in the book dates from 1912, while one of Ray Bradbury's few recent SF stories, "Come Into My Cellar" from a 1962 *Galaxy,* is less offensively mannered than usual but still rather old-fashioned with its extraterrestrial mushrooms. The 1912 surprise should not have been one: it is Rudyard Kipling's "As Easy as ABC," and it demonstrates again that Kipling will survive because he was a consummately good storyteller. This future crisis, in whch Chicago is in revolt against a cell of democratic reactionaries and the Aerial Board of Control has to step in and restore benevolent totalitarianism, is as lively as anything of Pohl's. (The Pohl contribution this time is "What To Do Till the Analyst Comes," a comedy of advertising which is doubly timely with the current furor over cigarettes.)

Although E. M. Forster's "The Machine Stops" is sixteen years younger than Kipling's story, and carries much more literary kudos around with it, it is far more dated by present standards. It was a daring innovation for Forster, perhaps, but dozens of nothing writers have handled the same theme better since 1928.

Currently, intellectuals are making horrified noises over the film, "Dr. Strangelove," which has converted the serious atomic-war paperback, "Red Alert," into a wild satire. Their party line seems to be that some things, such as the end of the world, are above ridicule. Well—one of their own company, Herbert Gold, does the whole thing in nine small pages in "The Day They Got Boston," beginning on page 129 of this collection.

Unfortunately, Analog isn't represented in this lot. Since the lamented days of Unknown Worlds, our magazine has been more serious than satiric. But you'll find authors who were and are well known here: Isaac Asimov, William Tenn, Evelyn Smith, Theodore Sturgeon, Frank Herbert. Hal Draper's direct little epitaph to "the literature," "MS FND IN A LBRY," *should* have been here. On the other hand, if Asimov were to write "strikebreaker" today—instead of a five-foot shelf of nonfiction every year —his best market would probably be *Playboy.* So might Evelyn Smith's hilarious little pastiche of that other portentious novel, "Fail-Safe"; she calls hers "Short in the Chest."

I went through this faster than any short-story collection in a long, long time, and had more fun.

DOOMSDAY WING

By George H. Smith • Monarch Books, Derby, Conn. • No. 388 • 1963 • 124 pp. • 35¢

In an article in *Saturday Review* for November 9, 1963 the authors of "Fail-Safe" list five types of trigger which, they believe, might initiate a final nuclear war between Russia and the United States. One is the technological failure of their book and the film based on it, not yet released. Another is the "madman" who insanely or out of ideology deliberately starts a war. This, in turn, has its subdivisions. "Red Alert," by "Peter Bryant," published as a paperback in 1958, made the madman a U. S. general. The author, now "Peter George," has converted his book into a totally different film: "Dr. Strangelove, or: How I Learned to Stop Worrying and Love the Bomb"—a macabre comedy with Peter Sellers in three parts.

In "Doomsday Wing" the agent is a Soviet officer, so that it is Russia that shoots first and triggers the holocaust. But the story is played out in a hidden base in the Rockies, near Denver, where a flight of Doomsday Machines are waiting to spread radioactive cobalt over the face of the Earth. If America appears to be defeated by a Russian attack, the officers of Doomsday Wing have the option of sterilizing the planet as they go down.

So, in the end, the conflict is one of personalities within the buried base. The author tosses the ball back and forth, so that the reader knows what is happening in Russia, and sees the trigger action approaching. Apart from the hero, though, the people of the Doomsday squad never come to life. The technology, which we can hope is fictitious, reads well, even though the author is George H. and not George O. Smith.

GREAT STORIES OF SPACE TRAVEL

Edited by Groff Conklin • Grosset & Dunlap, New York • Tempo Books • No. T-39 • 1963 • 256 pp. • 50¢

This is one of a series of paperbacks which Grosset & Dunlap are publishing especially for teen-age readers. It should have extra interest for readers of Analog because seven of the eleven stories in the collection first appeared here, in the magazine's Astounding days. Because the book is intended for new readers, it includes such familiar stories as A. E. van Vogt's "Far Centaurus," Eric Frank Russell's Hugo-winning "Allamagoosa," and Jerome Bixby's "The Holes Around Mars." But it has also brought back to light one of Poul Anderson's stories which I had forgotten or somehow missed when it was here in 1950. "The Helping Hand" is worth the price of the book, and it is especially useful for our own time.

I'd like to see what some of the good high-school teachers I have known could do with a free discussion of these stories. Because they are about as different from what the general public expects of space stories as you can get.

Take "The Helping Hand": two nonhuman races are offered a kind of Marshall Plan aid by Earth after a decimating war. One, a relaxed society much like the Polynesians of two centuries ago, accepts Earth's generosity and the strings which dangle from it. The other, patterned on the author's own Scandinavian forebears, is maneuvered into being rejected. But after fifty years, lovely Cundaloa has been washed down into a tepid, flavorless tourist trap while barbarian Skontar has rebuilt a civilization that is uniquely its own, developed a science unlike Earth's, and is carrying its own empire into Space. Are we right, then, to expect and demand that Latin America, Africa, Asia become feeble copies of ourselves in return for our aid?

Let's agree that Murray Leinster's "propagandist," with its faithful dog whose mind reveals the true nature of its human masters, is a little too pat. But there's a graphic demonstration in the story of the value a third party can have in seeing past the propaganda of two self-centered antagonists. Or Lester del Rey's "The Wings of Night"—is it foolishly sentimental to pass up a fortune for the sake of one nonhuman native to whom it nominally "belongs"? Is the premise of "Far Centaurus" legitimate—that five hundred years can totally change our society? Would the same span of time have had the same effect between 1,000 A.D. and 1,500, or between 1,500 B.C. and Solomon's time? Would there have been any discernible difference in the Lower Paleolithic of 150,000 years ago?

The collection, of course, also demonstrates that science fiction can be fun. There's the bureaucratic jape in "Allamagoosa," the tycoon-outwitted comedy of Jack Vance's "I'll Build Your Dream Castle," the improbably solved puzzle of "The Holes Around Mars," the picture of devious accomplishment in Isaac Asimov's "Blind Alley" . . . almost a companion-piece to the Anderson story. I'm not so impressed with Ray Bradbury's impressionistic tragedy of men dying in Space in "Kaleidoscope," or the too human nonhuman in Damon Knight's "Cabin Boy," and Arthur C. Clarke's "A Walk in the Dark" is just a well told spook story.

A very good introductory collection for teachers: the kids are already past this point.

REPRINTED AND REISSUED

AT THE EARTH'S CORE, PELLUCIDAR and TANAR OF PELLUCIDAR

By Edgar Rice Burroughs • Dover Publications, New York • No. T-1051 • 1963 • 433 pp. • Ill. • $2.00

The first three of Burroughs' stories about an impossible world inside the hollow Earth, where intelligent dinosaurs and an assortment of savage critters and people survive. These are the best of the series and reproduce the J. Allen St. John illustrations for the first two books. Paul F. Berdanier's frontispiece for "Tanar" is hardly worth the trouble. Since the reprint is based on the Grossett & Dunlap reprint editions, one St. John plate is missing from "At the Earth's Core."

THE CAVE GIRL

By Edgar Rice Burroughs • Ace Books, N. Y.

Very minor Burroughs of 1913 vintage. Weakling hero makes himself a Man to win the troglodyte heroine among primitives on a lost Pacific island.

THE VOYAGE OF THE SPACE BEAGLE

By A. E. van Vogt • Macfadden Books. New York • No. 60-146 • 1963 • 192 pp. • 60¢

This "novel" was patched together from some of van Vogt's first and best stories, including the classic "Black Destroyer". It hangs together better than most such *moulages*.

LORDS OF ATLANTIS

By Wallace West • Airmont Books, New York • No. SF-3 • 1963 • 128 pp. • 40¢

The Avalon edition in 1960 was a rather ordinary version of the "Greek gods were real people" plot.

THE MAN IN THE HIGH CASTLE

By Philip K. Dick • Popular Library, New York • No. SP-250 • 1964 • 191 pp. • 50¢

Last year's "Hugo" winner as best SF novel of 1962—a classic in the making. Now I can afford to give it away to people who "never read science fiction." The problem will be to find something as good to follow it up.

INVADERS FROM RIGEL

By Fletcher Pratt • Airmont Publishing Co., New York • No. SF-4 • 1964 • 127 pp. • 40¢

Pretty poor Pratt—even for 1932, when the original version appeared. Avalon had it in 1960.

BRASS TACKS

continued from page 5

he is unlucky enough to stop one that far off. But as for deliberately picking out someone that far off, and clobbering him, one would need very good fire-control, stable platform, and either a light-beam weapon, or a projectile weapon with a heavy, stable slug.

The weapons designed for this sort of performance exist, but most are mounted on wheeled carriages or tanks. Take the US/UK 105 mm tank gun, the Russian 85 and 100mm ditto, and the fearsome Flak 88 of twenty years back, and it isn't hard, though you may get some of the victim's neighbors also, even with a HVAP shot.

There is an outside chance a few portable weapons of the day could do it, but Oswald would have looked very odd trying to carry a 20mm Solothurn AT rifle up six floors, elevator or no, and he had been in poor shape for anything for a while.

The practical limit of even the best target rifles these days is not much beyond 1,000 yards, and after trying like hell to run over 90x100 on 36″ bulls at that range with an Army match type Winchester 70, I can vouch that the average shooter will not get them all under that washtub sized disk so far away.

When we come closer, the performance increases, to the point where below 200 yards, a good marksman with scope-sighted rifle very rarely misses, given a chance to rest his support arm, and clear vision.

As a matter of fact, the old 6.5 Carcano has never rated highly as a target arm, since the army using it relied on machine guns, mortars and artillery much more than we do. Some humorous Italian soldiers called it the "Humanitarian Rifle" since they claimed it couldn't hurt anyone on purpose. I once conversed with a Communist reporter who had served with a partisan movement, and he felt the Italian carabini was the world's worst shoulder weapon, for reasons he gave many of.

But with a scope properly mounted, and zero for short range established, we found that such a weapon could perform with lamentable accuracy.

This has resulted in various moves to ban private purchase of arms except through local purchase, and some clamor for a ban on private ownership of arms. Will this have any effect on crime, or the tenure of office of 1980's President?

John P. Conlon
52 Columbia Street
Newark, Ohio 43055

Hm-m-m . . . that's standard military and target-type guns. How about some of these hand-made specials the gun-nuts play with—the kind a really determined organization could get and use?

Dear John:

Forgive me for not typing, but this is written on a plane to Washington—I couldn't wait to get home, which is some time off.

When I started "The Permanent Implosion" in the February, 1964, issue of Analog I thought, after all these years how nice it is to have a story with some checkable facts and figures. But when I checked them, I was surprised to find that the author obviously hadn't.

I don't know how big the sphere of congruence was—let's say it was three feet in diameter. If the air density was the same near to it as remote from it—it would probably be lower near by—then roughly, one hundred fifty feet away the velocity of the air toward the sphere would be $(1.5/150)^2 =$ 1/10,000 that into the sphere. One thousand five hundred feet away it would be 1/1,000,000 that into the sphere.

But, what would be the velocity into the sphere? Surely, not more than the speed of air molecules, which is the speed of sound, which is about seven hundred seventy miles per hour. Thus we have as a generous estimate of the wind at various distances:

Distance, feet	Wind velocity, m.p.h.
1.5 (at the sphere)	770
150 feet	.077
1,500 feet	.00077

Before further comment, what about the depletion of the earth's atmosphere? The area of a three-foot sphere is about twenty-eight square feet or 1/1,000,000 square miles. Thus, at seven hundred seventy miles per hour the drain on the atmosphere would be .00077 cubic miles per hour.

The area of the earth is about 200,000,000 square miles. I don't know what the effective depth of the atmosphere is, but if it is three miles, then the volume is about 600,000,000 cubic miles. At a drain of .00077 cubic miles per hour the atmosphere would vanish in about 1,000,000,000,000 hours or about 100,000,000 years.

From this last figure, I infer that as far as the depletion of the atmosphere goes, there would be plenty of time to look for a solution, hence, why the haste?

Because, I suppose, of the winds and storms, which the author depicts so vividly, clearly, these must have had a supernatural origin—the above calculations show they couldn't have been caused by the flow of air through the sphere of congruency. The storms being so plainly supernatural would make them all the more terrifying.

I can see in the story a powerful myth depicting the overcoming of the powers of darkness by an adept with a degree in business administration—I always *knew* that that was black magic.

But John! What is a tale of supernatural terror doing in Analog?

J. J. Coupling

P.S. I'm dubious about putting the tanks in the pressure chamber. Why didn't he just put a valve on the intake of the supercharger and close it part way to give the desired reduction of pressure in the intake? But then, I'm just an engineer, not a practical man.

Hm-m-m . . . I guess I got too busy enjoying a good yarn to do any careful computing! It took No. 1 in the reader pool, so I guess most of the readers reacted that way, too!

LOUIS PASTEUR, MEDICAL QUACK

continued from page 7

recognize a real artist's touch.

That doesn't make it science. I've learned since that it not only wasn't science, it wasn't even honest reporting. The sample of Krebiozen the FDA reported on, according to data published in the "Congressional Record," was light tan in color, and fluorescent under ultraviolet light. Creatine is snow-white, and not fluorescent. The fact that any sophomore chemist would immediately recognize that an impurity was present seems not to have reached the scientists of the FDA's staff.

My objection was simply and solely to the specifically nonscientific methods being used in the name of Science in that instance. The letters I got—and the telephone calls—were from individuals who had a very different problem.

One typical one was from an electronic engineer in his late thirties. Four years ago he was operated on for cancer of the intestines; a year ago the cancer recurred. The doctors who examined the situation then told him that it had spread, and was inoperable; they could offer him only palliative medication that would prolong his life, and reduce the pain.

Six months ago, he started taking Krebiozen. The pain left, and the tumor shrank away.

The FDA has now announced that they have "determined" on the basis of "scientific evidence" that Krebiozen is ineffective because it is "nothing but creatine," and, therefore, have ruled that he cannot have Krebiozen any more; it will be illegal to sell it.

So what's his situation? In effect, the FDA is telling him to go back on a "morphine diet," and toddle off to the grave like a good little man, and stop messing around with these unorthodox treatments that aren't good for him.

I would like to raise a question here: Is it ethical for a group of men who can offer him no hope whatever, to deny him the right to *try* a remedy of which they do not approve?

For that matter, is it ethical to take from a man who is recovering, a remedy which *he believes* is curing him?

Any doctor knows that there is such a thing as a "placebo effect"; that a completely inert material, which the patient believes in, can produce an effect when a biologically potent material, which the patient distrusts, will not.

One example of that: an arthritis patient, when cortisone first began to become available, had been begging her doctor to let her have some. The doctor told her it was hard to get, but that he had a new remedy that was supposed to be almost as effective, and he would start trying to get cortisone for her as soon as he could. In the meantime . . .

He did, in fact, have cortisone on hand. He did, in fact, give her cortisone injections. For four weeks, she was getting cortisone, while the doctor told her he was trying to get some for her. She showed no improvement or reaction to the "substitute"—which was in fact cortisone. The fifth week, with great showmanship, the doctor told her the cortisone had finally come in, showed her the cortisone ampule with its label, filled a hypodermic with sterile saline solution, and injected that.

She showed immediate and dramatic improvement on the sterile salt-water therapy.

That phenomenon is one of the things that makes evaluating therapeutic techniques somewhat more difficult than measuring a voltage, or weighing electrons or the companion star of Sirius.

The field of medicine is one area where subjective reality and objective reality directly interact; they cannot be separated. The term "psychosomatic" has been sort of dropped, and a new term not including the offensive "psycho" term substituted; they are now called "stress-associated diseases," or "stress-associated" conditions.

Every indication is that cancer is a stress-associated disease.

With the above data in mind—is it ethical for any group of men to deny Krebiozen to an individual in the spot my telephone caller was in?

The problem in this whole area of medical therapy is acutely emotional; that is why such exceedingly bad "science" as the FDA's Krebiozen report keeps showing up. It's long been known that human beings tend to count their successess carefully, and forget their misses—and to forget the other guy's successes, and count all his misses. The more intensely emotional the situation, the more powerfully that tendency is manifested.

And medicine is the field where emotional forces are on a full par with objective forces. The problem is that that applies not only to the patient—*but to the doctor as well.*

Let me put it this way: Consider two ideals of what a doctor should be.

1. The patient wants a doctor whom he can trust not only as a wise and learned man, but as a friend in his time of trouble, a man with genuine sympathy and empathy—a man who is personally and genuinely concerned for his patient's welfare. Simply—a doctor should be a man who *cares* what happens to his patients.

2. The theoretical ideal of a doctor is a man who is highly trained, skilled, and intelligent, a man who thinks coolly and objectively at all times, in all emergencies, who does not get flustered, and whose judgment is not warped by emotional factors.

Look those two ideals over carefully—and you'll see at once that they are mutually exclusive. If a man cares—then he is influenced by emotional factors. If he is cool and objective—then he is not warmly sympathetic. Moreover, he'll make a poor doctor—because the emotional factor is a critical factor in the therapy of the patient, and the "cool, objective thinker" specifically withholds emotional warmth.

Now anyone—in or out of the medical profession—will agree that there are always some cynical men who become doctors as a way of making a high income, and getting high social status. And that such men do not deserve the title "doctor."

And if you think about it carefully, you'll recognize that the cynical, money-hungry, status-seeking M.D. will be coolly objective in his evaluations, his judgment will not be warped by emotional involvements. He will, in other words, closely approximate the logical-theoretical ideal of what a doctor should be . . . and that no one wants for a therapist himself!

Such a doctor is like a highly skilled mercenary soldier; he may be more skillful, more effective in the battle, than a true patriot dedicated to the cause. He fights coolly, effectively, and skillfully—but entirely without loyalty or dedication. He wants his side to win, because that's the side that will pay him for his work.

The man who is dedicated to a cause is, by definition, emotionally involved in it; his evaluations of that cause will not be objective. His judgment will be warped by his involvement.

A parent can not judge his child objectively; an Englishman can't evaluate England's policies in the world objectively, any more than an American can evaluate ours objectively. And a true, dedicated healer-physician can not judge medicine objectively.

Yet each of those—parent, Englishman, American and doctor—will be sincerely and honestly convinced that he is being objective.

And emotional involvement will make a well-trained, highly-logical scientist become completely unrealiable and unscientific.

It's long been known that it is very unwise of a doctor to treat his own family; his hopes and fears—his emotional involvements—will warp his judgment under precisely the circumstances he most ardently wants to be most effective. It is not ill-intent that warps his judgment, but excess of deep concern!

Strangely, a doctor could be more accurate in his evaluations when treating a man he despised than in treating his own wife or child.

Only the money-hungry status-seeking cynic—the medical mercenary with high skill and no dedication—can remain objective!

There's intense emotion on the part of the patients, too, of course; medicine is a matter of life and death, of health and crippling, of successful living or agony and slow death. No other success can have much value, if health is lost.

This leads to another aspect of the problem, one that affects the medical mercenary as acutely as the dedicated doctor. In our current society, the concept of the Welfare State and Security has spread to a quite unsane degree. People now demand Security against Death and ill health.

The Declaration of Independence was—as it openly states—prepared primarily as a propaganda document. It asserts that Life, Liberty and the Pursuit of Happiness are inalienable rights; this is a self-evident falsity. If they were inalienable, no one would ever have to defend them. The one truly inalienable right is the right to *try—with no guarantee whatever of success.* You have an inalienable right to *try* to live, to *try* to be free—but today, the Welfare-Security concept has promoted the concept that we should *have* those, that we should be guaranteed success in our efforts.

And—that a doctor should guarantee that there is no risk in his therapy.

The rise of that concept has led to more and more extreme malpractice suits. It used to be that if a woman was unfortunate enough to bear a Mongoloid idiot baby, she and her family would accept it as one of the risks of life and the life-process of reproduction.

Now they sue the doctor.

It used to be that if someone were unlucky and seriously injured in an automobile accident, they sued the driver who nearly killed them.

Now they sue the doctor who stopped by the roadside and rendered first-aid treatment.

Under this philosophy, Jesus' parable of the Good Samaritan would have wound up with the injured man suing the Good Samaritan for restoration of the money the thieves took.

This constitutes a problem for the medical-mercenary as well as the dedicated doctor. Such suits are always based on "second-guessing" the doctor on the job. "If he hadn't done . . . then I believe that . . ." is easy for the second-guessing doctor to say. (And a doctor willing to second-guess under those circumstances is always findable; the unskilled as well as undedicated medical mercenaries specialize in that as a source of income.)

Some human beings are violently allergic to wheat, strawberries or bee stings. This does not prove that wheat, strawberries or bees are deadly, lethal, evil, intolerable, terrible things to be eliminated from the world. It proves that the guy's unlucky in that *he* doesn't fit the world very well. It's not the world's fault—it's his fault.

But the man who turns up allergic to penicillin, thalidomide, MER-29, or some other new and highly useful drug—*he* sues the doctor.

It's a refusal on the part of patients to acknowledge that the act of living involves risk—and he *has* to accept that risk. Oh, no! Not under the Welfare-Security philosophy! He feels he is *guaranteed* success and health.

All of these factors focus in on the problem of new therapies, new drugs—plus one more.

Back before Pasteur discovered germs, Semmelweis discovered a 99.9% successful method of stopping childbed fever. There was a hospital in Vienna, one half of which was run by nuns, and the other half by doctors. The incidence of childbed fever in the doctor's half of the hospital at times ran as high as 90%—nine out of every ten young women who came in to have their babies died of infection. The nuns had a far better record.

The doctors didn't observe that fact particularly; the women of Vienna were acutely aware of it, however. (The human tendency to count your hits, and forget your misses—while the women observed the misses a lot more actively.)

Semmelweis, studying the situation, came to the conclusion that the difference was that the doctors, as part of their routine, performed autopsies on the dead women; the nuns did not. Semmelweis came to the completely false, crackpot notion that it was the odor of death on the doctors' hands that transmitted the disease. It just happened that he picked, as his deodorizer, chlorine water. It did indeed deodorize the doctor's hands; also, quite unknown to Semmelweis, it was an extremely powerful antiseptic—the concentration he used would kill anything.

At that time—about a century ago—it wasn't customary to wash the hospital sheets very often, either—until Semmelweis detected the "odor of death" there, too. "Wash 'em! And use chlorine water!"

The death rate from childbed fever among Semmelweis' patients dropped from about 90% to 0.9%.

For this, Semmelweis was thrown out of the hospital by the other doctors, and violently attacked and harassed by the medical profession of Europe.

Why? Because of a certain emotional factor involved.

His work—his absolutely unarguable and shocking success—said "Doctor—healer!—*you* killed those young women. *You* killed them with your dirty hands. They didn't just 'happen to die'; *you killed them!*"

Semmelweis was, of course, a dedicated healer; he could not endure standing idly by, so he was very busily spreading the word to laymen—telling them not to let a doctor examine a woman unless he scrubbed his hands in chlorine water.

There's the old saying "What you don't know won't hurt you." With respect to objective factors, that's obviously false. With respect to emotional things, however—it's true. So long as a doctor could hold off from his own mind the realization that it truly *was* his unclean hands that did it—then he did not have the grinding agony of regret.

Of course, the medical-mercenary type wouldn't have such a reaction; they could be more objective, less emotional. They never had cared particularly anyway—and Semmelweis' techniques would assure them of more patients. (Except for that damnable chlorine water; scrubbing in the stuff ruined the hands and devastated the fingernails. But it might presently be found that a dilute perfume—diluted with the usual 70% alcohol solvent—removed the odor of death just about as effectively.)

Of course, the Philosophical Logical Ideal doctors wouldn't resist Semmelweis' new idea; they wouldn't react to emotional factors like regret or remorse or guilt. And such men wouldn't be doctors worthy of the name, either.

In summary, then, the true, dedicated doctor, by the very nature of his dedication, cannot be an objective scientist; he cannot evaluate new proposed therapies objectively because he is dedicated—has a loyalty to his art. And he will have powerful emotional blocks against learning such lessons as Semmelweis taught, which show unmistakably that the doctor himself has been killing his patients through ignorance.

On top of that, the modern attitude that the patient has a right to perfect security, puts the doctor under terrific pressure to refrain from *any* new therapy.

Now let's consider for a moment what's meant by a "quack" in the medical field.

The usual charge is that a quack is someone who uses an improper treatment, one which does not help, or actually injures the patient, while inducing the patient to pay for this mistreatment, and keeping the patient from going to a licensed doctor and getting the treatment he needs. That a quack is in the business solely to make money at the expense of suffering humanity.

Now any time A disapproves of B emotionally, he'll attribute B's actions to some generally demeaned motivation—"just for money" being the most common, with "just for his own pleasure" being runner-up.

Let's be a bit objective about this business of what a quack does. Suppose a man, calling himself Dr. Jones, treats a patient who has a lethal disease, and uses a method that he knows for a positive fact will not save the man's life. He charges fees, and sees to it that the patient doesn't go to any other therapist—just gives him some drugs that do not save him, but let him die slowly.

That set of actions fulfills exactly what the AMA accuses those awful, nasty, wicked quacks of doing.

It is also precisely what an AMA doctor does when he treats a leukemia patient; he *knows* that the standard treatments for leukemia do not work, do not save lives. Leukemia, treated by AMA methods, means death.

The AMA, moreover, does everything in its power to make it impossible for the victim to get treatment from any other therapist who *might* be able to do better, and most certainly couldn't be less effective.

The patient will, moreover, wind up broke, and his family in debt—a charge constantly leveled against those wicked quacks!—by the time he dies.

But this is not quackery, of course.

Why not? Because the doctors know they are doing their best, with the best of intentions—which is strictly an emotional statement.

How about an unlicensed *non*-M.D. who does his best, with the best of intentions—despite the AMA's convictions that he *must* be evil—and actually does better than the AMA's best?

Oh . . . I see. That never happens, huh. . .?

Well, it hasn't yet been proven for leukemia . . . but how about that unlicensed non-M.D.—that charlatan, that fraud, who'd gotten crackpot ideas from studying silk-worms and wineries, no less!—who started treating human beings for rabies? That chemist, with only half a brain, Louis Pasteur?

Or how about that licensed M.D. charlatan, expelled from the hospital and the medical society—Semmelweis?

Or take a few other notorious quacks like Lister—who was most violently attacked for his temerity in opening the abdomens of living patients. (Ethical doctors of the time never opened the abdomen until after the patient died.) And Ehrlich, another chemist, who invented the concept of chemotherapy.

Every time someone outside—or even inside!—the field of medicine brings up a break-through discovery, he'll be labeled a quack. The field is too emotional.

He'll be charged with being a fraud, a charlatan out after money, a blood-sucking leech.

Hoxsey had something that appeared to help cancer cases. Standard Operating Procedure of the AMA is to deny it, and charge the innovator with being a fraud, a charlatan, a money-seeking leech . . .

Hoxsey sued the AMA, Dr. Morris Fishbein, their President, and the Hearst newspapers which published the statement, for libel. He won the case.

Whether his cure actually worked or not was never investigated; the AMA flatly refused to test it.

But the question of whether Hoxsey was a charlatan, a deliberate fraud, *was tested.* He wasn't. Whether he did, in fact, have a cure has nothing whatever to do with whether or not he was a fraud; a fraud is someone who knowingly and deliberately misstates facts. Hoxsey had excellent evidence to lead him to the conclusion that his cure worked; that fact alone is complete and final proof that he was not illy or fraudulently motivated.

Look—let's be objective. Hoxsey may have been wrong—but the AMA doctor who treats leukemia by methods *he knows* will not save the patient's life seems to me in a damn poor position to call Hoxsey a quack. Hoxsey didn't *know* he couldn't save lives, and did, in fact, have a lot of reason to believe he could. And Hoxsey wasn't urging the passing of laws that would prevent the victim of such a disease from even trying to get help elsewhere.

As I say—this whole business is a mass of tangled, boiling, violent emotions. Does intent count in such matters? How much should it count? How do you know a man's real intentions? The medical mercenary intends to make money and gain status—and he may be the most highly skilled, highly competent surgeon in the city. Another man may be deeply dedicated, completely sincere . . . and unfortunately just not really bright. He lacks the spark that makes real surgeons. So here is one man with the "evil" intention of making money, the medical mercenary, and another who has the best of intentions. And—should we say the incompetent man is a better doctor?

I propose a new approach to this problem.

Let's license quacks. We'll make it wide open; anyone whatever, with no qualifications required save only that he be over twenty-one, and never committed to an institution for insanity, can apply for and get a license to set up in business as a medical quack.

Here's why: If a doctor diagnoses a man and tells him "The disease you have will kill you within three months; there is nothing that we can do to save you. All we can do is give you drugs to ease your pain, and perhaps prolong your life a little," that man is unsane if he does not seek some other therapist. And a man does have an inalienable right to try to live; you may try to stop him, but you'll have to lock him up to prevent his trying to find someone who will offer him some hope.

The fact that there are conditions which can be diagnosed, but which can not be cured by medicine today—and there always will be, no doubt!—is the fundamental reason why there are, and always will be quacks.

A quack is a man who thinks he can help conditions medicine cannot help. A man like Louis Pasteur, treating the Russian victims of rabies with a new technique no doctor in Paris would touch—treating them at the risk of a trial for murder, if they died.

Not all quacks are evil men. And there is a definite place for quackery! The area where medicine is competent to diagnose, and helpless to cure. If medical science can't help—then by all that's honest and ethical, they should damn well acknowledge it, step aside, and let someone else try!

Try a witch doctor, a faith healer, a numerologist—try a herbalist, or a chemist with a theory, or maybe a nuclear physicist. When you have nothing to lose, and life to win—*try anything!*

And *don't talk about money!* Whenever emotions start running high—and they always do, everywhere, in medical problems!—the business of money charges gets thrown in as the triumphant "That proves they're wrong! They do it for money!"

Have you taken a look at a standard AMA hospital and doctor bills for a couple of months of cancer treatment, with death of the patient? Talk about money! See, that proves they're just doing it for the money, huh?

Drop that money nonsense out of

the thing; it's a question-begging argument from start to finish.

On the patient's side, he has a right to try anything he chooses; the organized medical groups have no right to deny him the right to try.

But there's a doctor's side, too. We're going to license these quacks—but it will be strictly, publicly, and thoroughly understood that it's a matter of "When you choose to gamble—you can't whine if you lose your bet." The quack is absolutely immune to suits for malpractice. Legally declared totally irresponsible for any deaths, crippling, or disasters that may result from his treatments.

This is simply putting into formal, legal and publicly stated terms what exists in fact anytime a man goes to a quack; it is the patient's responsibility to choose his own quack—and to take his licking if he gets licked.

But this means that a licensed M.D., a qualified man with a new theory, a new therapy to try out can *also* take out a license as a quack. He can hang out his shingle as "Thomas R. Brown, M.D., Licensed Quack Specializing in . . ." whatever it may be he's researching.

This would give the doctor a chance to do experimental work, and get out from under that insane business of unlimited malpractice suits. If the patient insists on Security—he goes only to tried-and-true, standardized-technique licensed doctors. If he has a disease in which the standard therapies don't work—he can take his choice of being perfectly secure in his dying, or sticking his neck out and taking a chance on a new therapy.

There's a third side to this system though—Society as a whole. And Society as a whole will benefit enormously from a system of licensed quackery.

Quackery always has existed; it exists now—and it always will exist, for the reasons given above. Diagnosis always precedes therapy; diagnostic techniques will always exist before therapeutic techniques have been able to cure the newly diagnosed conditions. In that twilight zone, quackery exists.

Now, however, quackery is illegal—a hit-and-run business pretty largely. No undercover operation can keep good records, and what records it does keep aren't communicated.

Let's license the quacks . . . and *make them keep extremely careful records*. They'll be the most useful research records Mankind has ever assembled! Even if the quack himself doesn't learn anything, other men very well may, from studying the records.

Now, the quacks are unlicensed, and, therefore, unlimited. (They aren't even limited to over twenty-one and no-recorded-insanity!) Licensed, they can be limited in a number of ways—but the ways *will not* include any requirement of degrees or previous training. Put on such limitations, and the unlicensed quacks will immediately pop up where their records won't be available, and their activities will be unrestrained. The only restraint will have to do with two matters of statistics:

1. Only patients diagnosed as having diseases or conditions which standard medical records show to be, say, seventy-five per cent or higher lethal under known treatments will be automatically free to go to a quack if they want to. If the disease or condition is nonlethal, and has a zero cure rate—some skin diseases for example—the patient can ask for and *must be given* a pass to present to a licensed quack. The patient, not the doctor must determine this—because patients who want to go to quacks and are denied the pass will supply a group to maintain unlicensed and unrecorded quacks. But it gives the doctor a chance to point out to a girl with a disfiguring and incurable skin condition that while a *quack* might cure it—he's also quite apt to kill her.

But . . . any quack caught treating someone who does *not* have such a pass loses his license, and gets jailed.

2. The statistics on the quack's records are studied periodically. If his death rate is higher than the death rate under standard treatment—he gets shut down. We want better, not worse, treatments!

The gain to the Society as a whole is that, by such a system, a huge number of things that might work can be explored with the full co-operation and free permission of the self-assigned human guinea pigs. No man *has* to go to a licensed quack; it's his decision to be a human guinea pig. And in the process, we can learn a great deal about a lot of things that don't work—and thereby eliminate duplication of that useless effort.

There's a lot of emotionalism tied up in that concept of the human test subjects, of course. Doctors, when fulminating against quacks, have horrid things to say about such things.

But dedicated doctors, knowing the importance and good intent of what they were doing, aren't so upset when doctors in a major New York hospital, inject live human cancer tissue into human patients without the knowledge or consent of the patients.

That's *different!* That was for a good purpose, and they knew what they were doing!

Actually, it's pretty clear, the definition of "quack" is "someone I believe to be dangerous, evil, destructive and unprincipled."

Trouble is—the term "quack" was—in their own place and time—violently hurled at many men we consider today among the greatest medical heroes. Jenner—Harvey—Ross—Lister—Pasteur—Ehrlich—Sister Kenny—even Roentgen, who didn't even try to practice medicine!

One very certain thing about the field of medicine: it is not, and never will be a field of objective science. It's too deeply dominated by emotional factors.

The Editor.

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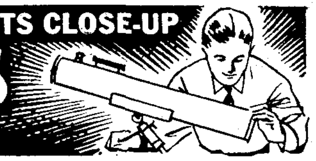
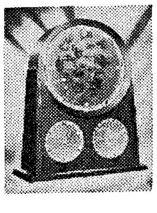


AUTOMATICALLY SHOWS TIME, TIDES, POSITION OF SUN, MOON, STARS



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Startling scientific achievement, yet completely practical and functional. Designed for the space age by world renowned scientist, Dr. Athelstan Spilhaus, Dean of Technology, University of Minnesota. Handsome conversation piece—constantly up-to-date encyclopedia of the sky. The Spilhaus Space clock has beautiful fruitwood case and 3 sky-blue dials. Blends with decor of any home, office, club room, classroom, museum, hotel, etc. Large dial shows sun position, daily sun rise and set, moon position. moon rise and set. phase of moon. low and high tide time, current stage of tide, day and month of year, current position of stars in *sky, time of star rise and star set,* relationships of sun, moon and stars, sidereal or star time. Left dial shows local time. Right dial shows world time including major U.S. cities and Universal (Greenwich) time. Operates on house current—requires only one simple setting for any geographic location. Measures 10" high x 11½" wide x 4½" deep. Presentation plaques available. Complete satisfaction guaranteed or money refunded.

Shp. wt. 12 lbs.

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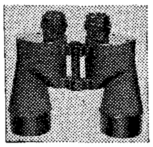

War Surplus! American-Made 7x50 Binoculars

Big savings! Brand new! Crystal-clear viewing—7 power. Every optical element is coated. An excellent night glass—the size recommended for satellite viewing. Individual eye focus. Exit pupil 7 mm. Approx. field at 1,000 yds. is 376 ft. Carrying Case included. American 7x50's normally cost $274.50. Our war surplus price saves you real money.

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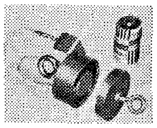

Hobbyists, instructors and industrial lab men will find this well-built Electro-Magnet invaluable. Demonstrate principles of electro-magnetism. Actually lifts 100 lbs. when powered by a single 1½V flashlight battery. Easily deactivated. Includes instructions for 6 experiments—lifting power, magnetic flux and magnetomotive force, air gap, area of contact, retentivity and field configuration. Unit includes magnet and yoke assembly, battery holder, leads, clips and eyebolts. Steel core and yoke precision ground for max. flatness. About 2½" dia. x 4½" lg. Wt. 2 lbs.

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Best pocket magnifier made—easily worth over $10. Flat field, no distortion, no color fringes. Sturdily mounted in black anodized aluminum case. Swings into chrome plated protective handle when not in use. Ring for attaching to chain or string. Sizes: closed, 1¼" x ¾" clear lens, 7/16". Field of view 9/16".

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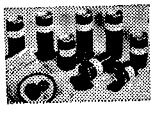

CRYSTAL GROWING KIT

Do a crystalography project illustrated with large beautiful crystals you grow yourself. Kit includes the book "Crystals and Crystal Growing" and a generous supply of the chemicals you need to grow large display crystals of potassium aluminum sulfate (clear), potassium sulfate (purple), potassium sodium tartrate (clear), nickel sulfate hexahydrate (blue green) or heptahydrate (green), potassium ferricyanide (red), and copper acetate (blue green).

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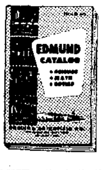

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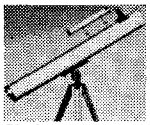
BE READY FOR THE MOON SHOTS

Ranger, Surveyor, Lunar Orbiter unmanned space probes will shed exciting new light on the mystery of the moon and outer space. See the results close-up. Edmund low-cost, top-quality equipment and accessories put you right there—pro*vide valuable and complete information to keep you on* target.

Bargain! 3" Astronomical Telescope



See the stars, moon, phases of Venus, planets close up! 60 to 180 power—famous Mt. Palomer Reflecting type. Unusual Buy! Equipped with Equatorial mount; finder telescope; hardwood tripod. Included FREE: "STAR CHART"; 272-page "HANDBOOK OF HEAVENS"; "HOW TO USE YOUR TELESCOPE" book.

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Intriguing Low-Cost Moon Model

Exciting outer space display and conversation piece. Exact replica. 30,000 formations—peaks, craters, Ocean of Storms, etc.—in relief. Scaled to size. Accurate distance relationships. Proper lighting shows moon phase; "black light" startling effects. Tough, washable plastic. Three colors. Far side blank—can be used for space data. Excellent gift item. 12" dia., wt. ¾ lb.

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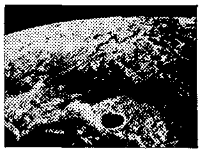
A SLIDE TRIP TO THE MOON—MOON TOPOGRAPHY STUDY AID



As the universe shrinks, interest in astronomy increases. This highly informative series of 29 black-and-white slides features such topography as the southwestern limb and Mare *Imbrium—the "pearl of the* moon." Also, full moon taken with Mount Wilson 100-inch reflector and the crater Clavius through the 200-inch.

Stock No. 60,348-A ....**$5.00 ppd.**

BIG DETAILED 35" x 46" MOON MAP

Black and white photo reproduction of full moon with all named lunar formations clearly marked. Complete index to locations and other valuable information.

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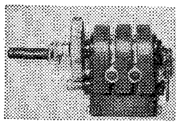
WAR SURPLUS ELECTRIC GENERATOR



Brand new Signal Corps Electric Generator for scientific experiments, electrical uses, demonstrations. Generates up to 90 volts by turning crank. Use in high impedance relays. Charge ground and bring up night crawlers for bait or study. 2 Alnico Magnets alone worth original price. Wt. 2 lbs. Cost to Govt. $15.

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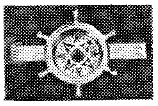

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BLACK LIGHT MAGIC-GLOW KIT

With this Kit, you can collect fluorescent rocks, paint with living light, write secret messages, learn invisible detection methods, even make a fluorescent Christmas tree! Kit uses long-wave blacklight, which is completely harmless to eyes, but causes fluorescence in over 3,000 substances. Includes Magic Glow Lamp, universal laboratory lamp stand, invisible water paints and ink, fluorescent crayon, tracer powder, pen, 3 brushes, specimens of fluorescent rocks: wernerite from Canada, fluorite from England, willemite from U.S.A. Plus book of 40 experiments.

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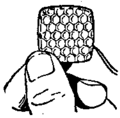

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*Experience endless fascination in convert*ing sunlight into electricity to power small motors, amplifiers, etc. Ideal for scientific student projects. Silicon Cell has plastic case 1⅛" x 1⅛" x 3/16". Produces .3 to .45 volts—10 to 16 milliamps. 24-page Handbook included. Gives data on 12 experiments.

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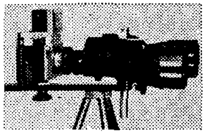

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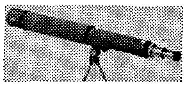

Fine quality, erect image zoom telescope, for naturalists and hobbyists. 50 mm hard coated, achromatic objective. Separate zooming and focusing adjustments. Field of view at 25X is 1-degree, 30 minutes; zooms to 0-degrees, 35 minutes at 80X. Magnification scale marked on eyepiece mount. High resolution over entire field. Excellent for both terrestrial and celestial observation. Includes sunglass for safe solar observation. 22½" long on sturdy *10" tripod.*

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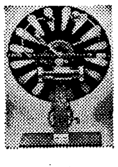

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Sturdy, Improved Model

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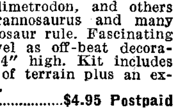
MINIATURE SUBMERSIBLE WATER PUMP FOR HOBBIES, EXPERIMENTS



Sturdily built, self-priming, electric water pump. Ideal for science classes, advertising exhibits, miniature waterfalls, fountains, etc. Operates under water on 8 to 20V AC. At 20 V, pumps 1 pint per minute at 12" head, spare valve, spring and instructions included. Plastic, 2½" lg., 1" dia; wt. 1¼ oz.

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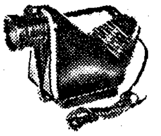

Terrific Buy! American Made! OPAQUE PROJECTOR

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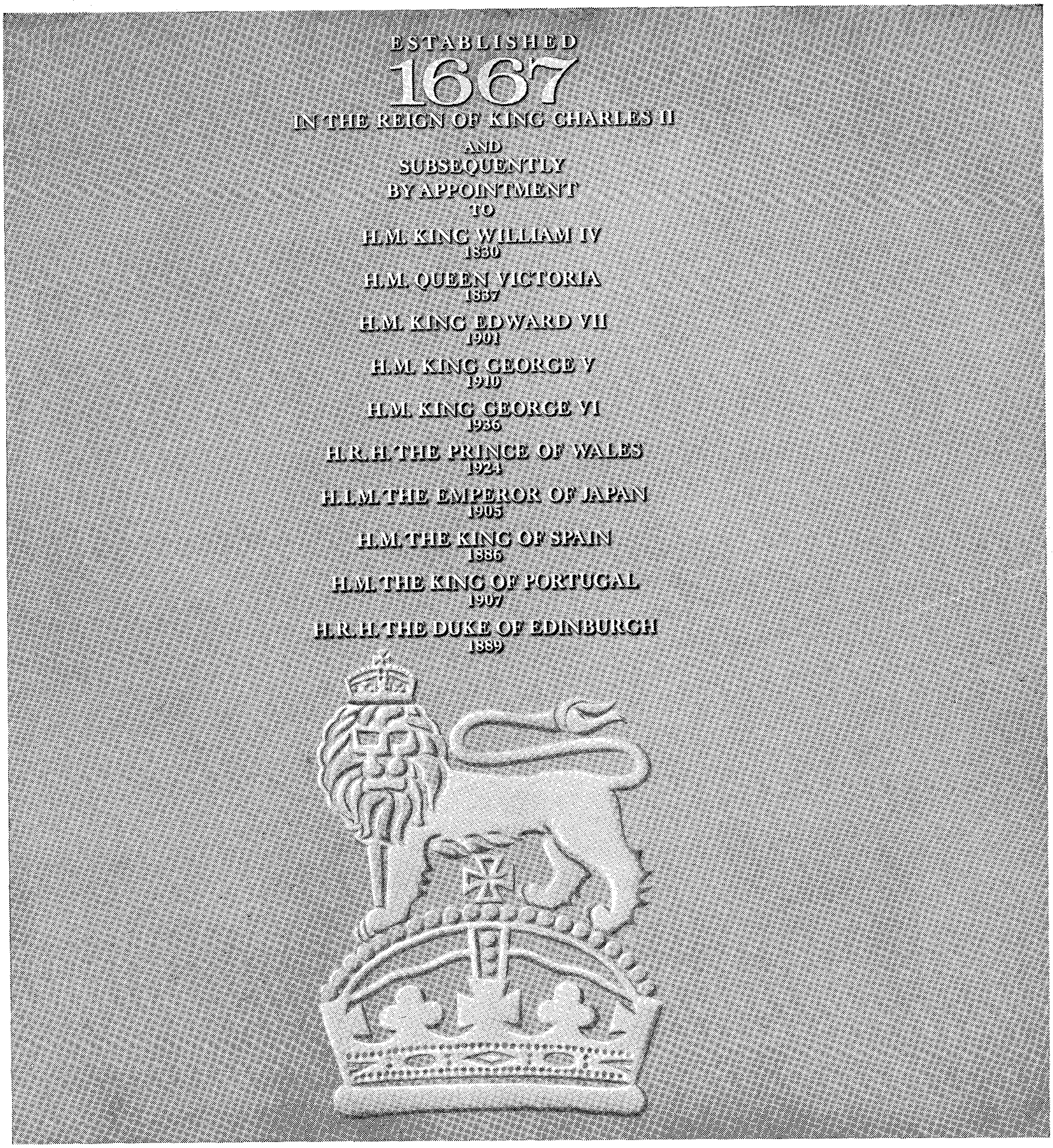

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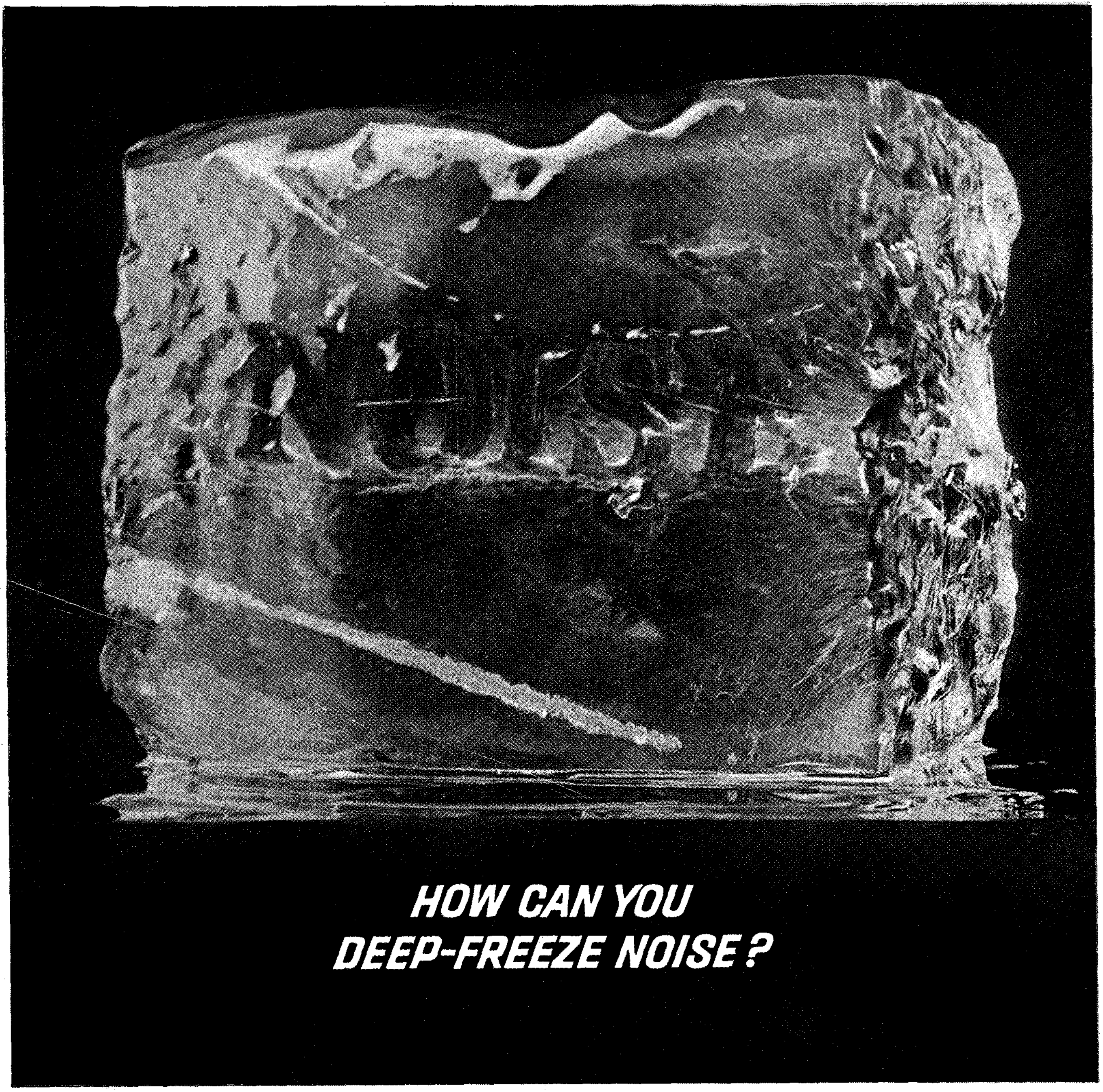

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